Developing and Evaluating Approaches for Utilising Injury Data to Support Product Safety Initiatives

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Abstract

Increasing requirements to understand product-related injuries have resulted in a need for evidence-based research to effectively address product safety issues. Data regarding injuries are claimed to be vital for supporting the product safety system ((Productivity Commission, 2006). This study aims to improve product safety information through the analysis of existing injury data and the assessment of its contribution to product safety initiatives.

This study analysed paediatric injury data collected between 2008 and 2010 sourced from the Queensland ED-based injury surveillance Unit (QISU) and the Queensland Hospital Admitted Patient Data Collection (QHAPDC). The injury data were analysed to identify and quantify product-related injuries based on three product safety prioritisation criteria: frequency, severity and causality.

The PhD research was divided into four studies. Study I involved a preliminary analysis of injury data to identify and quantify product related injuries in the ED-based injury surveillance data using product-related codes. In Study II, a more in-depth analysis was conducted using the ED-based injury surveillance data to examine injury severity and causality. In Study III, the hospital admission data were analysed based on frequency, severity and causality. Both datasets were analysed based on major mechanisms of injury and the three criteria of product safety prioritisation. At the end of each study, product-related injury mechanisms were prioritised based on the prioritisation criteria. Study IV involved a retrospective on-site medical record review to evaluate the extent of useful documentation in hospital records for product safety stakeholders.

Overall, product-related injuries accounted for approximately 35% of all paediatric injuries recorded in both injury datasets. Based on the severity analysis using the ED-based injury surveillance data, approximately 12% of product-related injuries resulted in admission to a hospital and 5% were classified as requiring urgent emergency treatment. In the hospital admission data, approximately 9% of product-related injuries required a phase of hospital treatment with an average length of stay of approximately two days. In the causality analysis, product causality was able to be identified in approximately 6% of all paediatric injuries in the ED-based injury

surveillance data. The frequency, severity and causality analyses of current data suggested that injuries related to thermal effects, foreign bodies and falls should be prioritised in product safety initiatives, as these mechanisms of injury had the greatest frequencies of occurrence, the highest severity and were associated with the most prevalent products causing injury.

This research project provides information on techniques for interrogating health data to identify trends and patterns in product-related injuries that can be used to inform product safety prioritisation. This research also provides input into the development of health classifications to improve the ability to classify product-related injuries in routine data collections.

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List of Abbreviations

ACCC	Australian Competition and Consumer Commission
AIHW	Australian Institute of Health and Welfare
AIS	Abbreviated Injury Scale
CHIRPP	Canadian Hospitals Injury Reporting and Prevention Program
CPSC	US, Consumer Product Safety Commission
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th Edition, Australian Modification
ICISS	International Classification of Disease Injury Severity Score
IDB	European Injury Database
LOS	Length of stay
MIF	Major Injury Factor
MOS	Mode of separation
NEISS	National Electronic ED-based injury surveillance System
NDS-IS	National Data Set for ED-based injury surveillance
NISPP	National ED-based injury surveillance and Prevention Program
NISU	National ED-based injury surveillance Unit
PIF	Product Involvement Factor
QHAPDC	Queensland Hospital Admitted Patient Data Collection
QISU	Queensland ED-based injury surveillance Unit
SRR	Survival Risk Ratio
VISU	Victorian ED-based injury surveillance Unit

Glossary of Terms

Consumer product	Any that are intended to be used or likely to be used by consumers.
Product-related injury	An injury in which one or more consumer products were involved anywhere in the injury circumstances.
Injury Frequency	The count or number of injury cases identified in the data.
Injury Severity	The intensity of the damage to the body as a result of the injury event which can be assessed based on disability and fatal outcome.
Product Causality	A condition where a product plays an essential role in producing an occurrence of injury or damage.
Proactive approach	An enumeration process of all product-related injuries recorded in the data and identifying the type of product and/or injury with the highest frequency for prioritisation.
Reactive approach	A process of identifying injuries that are related to a specific known type of product.

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

QUT Verified Signature

Signature:

Date: 19 March 2015

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CHAPTER 1: INTRODUCTION

Chapter 1: Introduction

This chapter outlines the background (section 1.1) and context (section 1.2) of the research. Definitions are provided (section 1.3) and the purposes of the research explained (section 1.4). Section 1.5 describes the significance and scope of the research. Finally, section 1.6 and 1.7 includes the study details and an outline of the remaining chapters of the thesis.

1.1 BACKGROUND

Consumer product safety has been recognised as a global issue for approximately four decades. A consumer product is defined as any item that is "intended to be used or likely to be used by consumers" (Productivity Commission, 2006). This work adopts a similar definition for its interpretation of product safety issues, with an aim to improve product safety information and systems for the benefit of Australian product safety regulators. As some products included in the Productivity Commission's definition are regulated by government bodies outside the bounds of product safety regulators, this study focuses only on products within the regulator's jurisdiction. Where a product falls within multiple jurisdictions, it is included where product safety regulators have a degree of influence or interest in its distribution. Several developed countries such as the U.S., Australia, Canada and countries within the European Union have been trying to address the issue of product safety through the introduction of consumer product safety policies and enforcements (Rogmans, 2000). Australia was among the first few countries to initiate a product safety system, after Canada, US, Germany and Japan. It was first introduced through the establishment of the Trading Practice Commission in 1974 which later became the Australian Competition and Consumer Commission (ACCC) in 1995 (ACCC, 2014e). Product safety requires continuous attention and monitoring due to rapid developments and innovation in consumer products. The ACCC has estimated that there are approximately 15,000 types of products available in Australia (ACCC, 2014d). This number becomes significantly greater when multiplied by the number of brands and more specific product types in the market (ACCC, 2014d). All of these products have the potential to harm consumers who use them without adequate safety controls and monitoring in the product market. A study from Victoria estimated that 70% of all unintentional injuries occurring between 1991 to 1992 were related to consumer products, of which at least 15% of injuries were due to product malfunction (Watson & Ozanne-Smith, 1995). It was also estimated that the total health sector expenditure to treat these injuries was $238 million (Watson & Ozanne-Smith, 1995). Since then, the product safety system in Australia may have been improved. However there is no current study that reflects the change in cost figures.

It can be argued that children are more vulnerable to product-related injury and fatality compared to other age groups. Young children particularly, who are still in their physical and cognitive developmental stages are at even greater risk. Children are likely to use products in ways other than their intended use, due to their lack of understanding and cognitive ability to avoid product hazards. In Queensland, data from the Queensland Emergency Department-based injury surveillance Unit (QISU) showed a higher proportion of product-related injuries occurred among children aged 0 -17 years old, accounting for 37% of all reported injuries, compared to 26% of injuries amongst consumers 18 years or older (See Appendix 1). Corresponding to these findings, product safety regulators in Australia have concentrated primarily on intervening on products which pose hazards to young children. The latest review of the Australian product safety system conducted by the Productivity Commission highlighted the importance of taking into account vulnerable groups, including children and the elderly in the consideration of product safety risks (Productivity Commission, 2006). Since the launch of the Australian Consumer Law in early 2011, there has been an increase in children's product regulation. Currently, almost half (11 product bans) of the banned products across all ages in Australia are associated with hazards to children, with 6 of these product bans were applied after the launch of ACL (ACCC, 2013b).

An increasing need to understand product-related injuries has resulted in a requirement for evidence-based research, of which injury information forms a vital component. A Queensland Trauma Data Scoping study identified 20 agencies that collect injury information of relevance to product safety (QLD Trauma Data Scoping Project Team, 2008). Despite the comprehensive range of agencies collecting injury information, the Ministerial Council on Consumer Affairs (MCCA) claims that injury data sources are not currently being used to their full advantage to support the efficiency, effectiveness and responsiveness of an injury early warning system (Productivity Commission, 2006).

The use of injury data to support product safety is currently limited by several issues. Firstly, injury data are collected at different levels of care and in varying health care settings. This multiplicity creates accessibility issues relating to confidentiality and other privacy matters. In some cases, access to the injury data is allowed, but only through a lengthy and complex application and approval process. Secondly, injury data are commonly stored and coded based on health classifications which are designed for clinical and health statistical use. These classifications are often limited in their ability to classify cases based on the type of product causing the injuries. The difficulty in gathering and being able to collate injury data from several data sources with different health classification systems compounds and convolutes the process even further.

1.2 CONTEXT

This study is derived from the need for evidence-based research to support the product safety system in Australia. Queensland hospitals' injury data, as one of the main sources, will be used to identify consumer product-related injuries. Products in this study are limited to 'consumer' goods, as determined by the definition of a consumer product used by the Productivity Commission for product safety regulation processes (Productivity Commission, 2006) and includes products intended for personal, domestic or household use .

The study will focus on examining product-related injuries in children aged 0 to 17 years due to the fact that compared to other age groups, children are most vulnerable to product-related harms, as outlined above. The types of product included in this study are those included within the product safety regulator's jurisdiction of Australia, including those products that are in a grey area of overlapping jurisdictions between the regulators and another body.

1.3 DEFINITIONS

The term *injury* underpins the concept of injury prevention and ED-based injury surveillance. The scientific use of the term is relatively new, following opposing discussions around the use of the term *accident*. Critics of the use of the word ‘accident’ cite the notion of human error which excluded consideration of other factors that may contribute to the cause of the incident (Robertson, 2007). The connotation of ‘accident’ is also linked to the notion of fate, which constrains the need to prevent or control the occurrence of such an incident (Bangdiwala, 2000). Injury prevention emerged when people started to understand that injuries are predictable and preventable (Bangdiwala, 2000). Moreover, the term *injury* was adopted to include the prevention of non-accidental injuries into the injury prevention field (Robertson, 2007).

In this study, product-related injury is defined as an injury in which one or more consumer products were involved anywhere in the injury circumstances. Product-related injuries will be analysed based on frequency, severity and causality criteria. Frequency of injuries is defined as the count or number of injury cases identified in the data to describe the magnitude of the injury burden (Driscoll, Harrison, & Langley, 2004a). Severity of injury in this study is defined as the intensity of the damage to the body as a result of the injury event (Cryer, 2006), whereas causality is defined as the factors that contribute to the production of an injury occurrence (Stevenson, 2004).

Moreover, in the identification of product-related injuries, a proactive approach will be used to interrogate the injury data. A ***proactive approach*** in this study is defined as an enumeration process of all product-related injuries recorded in the data and identifying the prominent product safety issues portrayed by the injury data. For example, injury data is interrogated to identify the top ten products causing injuries.

1.4 OBJECTIVES

The aim of the study is to improve product safety information through the analysis of existing injury data. The specific objectives of this study are:

1. To identify and quantify the frequency of product-related paediatric injuries (children aged 0-17 years) in emergency presentations (Study I & II) and hospital admissions in Queensland (Study III).

2. To identify and quantify the severity of product-related paediatric injuries in emergency presentations (Study II) and hospital admissions in Queensland (Study III).

3. To identify and quantify the causality of product-related paediatric injuries in emergency presentations (Study II) and hospital admissions in Queensland (Study III).
4. To evaluate the extent of useful documentation in emergency ED-based injury surveillance data and hospital records for product safety stakeholders (Study IV).
5. To develop methods for prioritising product-related injury mechanisms based on severity, frequency and causality measures. (Discussion)

1.5 SIGNIFICANCE & SCOPE

This research project provides information on techniques for interrogating health data (particularly ED-based injury surveillance and hospital admission data) to identify trends and patterns in product-related injury and to inform product safety prioritisation. Currently, injury data are underutilised in Australia and many countries worldwide to inform product safety initiatives. The literature review for this research has identified approaches and techniques that have been utilised in other countries where injury data have been used to support product safety surveillance systems. While injury data have been used in other countries (as detailed in the literature review), there have been limited studies conducted internationally to develop methods of using the data for the prioritisation of focal areas. Secondary data analyses of Queensland ED-based injury surveillance and hospital admission data were expected to determine whether or not similar approaches can be used in the Australian setting. This research also provided input into the development of health classifications to improve the ability of coding systems to capture common products causing injury.

This PhD study is part of a larger collaboration being conducted by the Centre for Accident Research & Road Safety Queensland (CARRS-Q), supporting the ongoing work of the Consumer Product Safety Injury Research Advisory group (CPIRAG) which the candidate is contributing to. This study outlines recommendations to inform product safety prioritisation to promote the role of injury data to support decision making for product safety regulation.

1.6 STUDY DETAILS

The PhD research was divided into four studies. The methodology and rationale of each study are outlined below.

Study I involved a preliminary analysis of injury data to identify and quantify product-related injuries in Queensland ED-based injury surveillance data using product-related codes. A secondary analysis of paediatric injury data was performed using data from the Queensland Injury Surveillance Unit (QISU) collected between 1 January 2008 and 31 December 2010.

In studies II and III, the analyses performed in Study I were extended by involving several in-depth secondary data analyses using QISU data (Study II) and hospital admission data (Study III). Data was analysed in terms of major mechanisms of injury and the three criteria of product safety prioritisation – frequency, severity and causality – were used to identify priority products. At the end of each study, product-related injury mechanisms were prioritised based on each of the three-prioritisation criteria.

Study IV involved a retrospective on-site medical record review to identify any missing information that was not captured in the coded hospital admission data. The aim of the study was to evaluate the extent to which medical records contain core product-relevant information beyond what is coded in routine data, and to identify the degree to which product involvement in injuries is documented.

Each individual study provides findings that apply to the three prioritisation criteria (frequency, severity and causality) and as such, the chapters are structured according to the three prioritisation criteria, not according to the studies.

1.7 THESIS OUTLINE

The thesis is structured into three literature review chapters and four findings chapters. The literature review chapters discuss the two main study areas separately (product safety and ED-based injury surveillance) and combine both study areas in the third chapter. The finding chapters are structured so that each component of the prioritisation criteria explained above is presented separately, with sections for methods, results and a discussion of the findings. The final chapter is designed to utilise the overall findings from the preceding chapters to prioritise product safety issues based on a consolidation of the three product safety prioritisation criteria.

Chapter 2 provides a review of literature related to the product safety systems in Australia as well as from around the world. This chapter covers the significance and scope of a product safety system as well as the theoretical framework of product risk assessment.

Chapter 3 provides a review of literature related to the ED-based injury surveillance systems in Australia as well as from around the world. The theoretical framework around injury prevention and the significance and scope of ED-based injury surveillance systems are covered in this chapter. Several examples of international ED-based injury surveillance systems and injury data sources in Australia are also discussed in this chapter.

Chapter 4 provides a review of literature on the utilisation of injury data to support the product safety system. The theoretical framework around product safety prioritisation criteria: frequency, severity and causality, are discussed in this chapter.

Chapter 5 focuses on the frequency of product-related injury in injury data. This chapter discusses the different methods of identifying product-related injury.

Chapter 6 focuses on the severity of product-related injury in injury data. This chapter discusses the different severity measures that are currently available and used in the injury prevention field as well as for product safety around the world.

Chapter 7 focuses on the causality of product-related injury. This chapter discusses the adoption of the Product Involvement Factor (PIF) classification system to determine the causality of the injury in which a product is involved.

Chapter 8 is a general discussion pertaining to each of the findings from chapter 5, 6 and 7 and the prioritisation of product safety issues in Queensland based on these findings. Recommendations are made to both systems: to the ED-based injury surveillance administrator and classification administrators for further development and improvement of injury data, and to the product safety regulators for techniques and options to interrogate the currently available injury data.

Chapter 2: Literature review Product Safety System

Chapter 2: Literature review Product Safety System

This chapter will explore the concepts and frameworks related to the product safety system. The definition of product safety will be discussed in section 2.1. Examples of several product safety systems from around the world will be outlined in section 2.2. Section 2.3 will focus on the history and reformation of the Australian product safety system. Furthermore, product risk assessment as the overarching framework in product safety systems will be discussed along with several examples of risk assessment tools. Product safety interventions and data needs of the product safety system will be explored in section 2.5 and 2.6.

2.1 DEFINING PRODUCT SAFETY

According to the Organisation for Economic Cooperation and Development (OECD), the product safety system in a country is intended to serve three core objectives: 1) to address actual and potential market failure, 2) to protect customers from product-related harm and 3) to minimise the cost of product-related injuries (Organisation for Economic Cooperation and Development, 2009). In order to address the objectives above, it is essential to define ‘products’ and ‘safety’. Currently in Australia, there is a vague definition of ‘products’ which obscures the identification of product-related injuries. The Productivity Commission defines consumer products as “any that are intended to be used or likely to be used by consumers” (Productivity Commission, 2006). Some products included in this definition, however, are regulated by other government bodies and are therefore excluded from the above definition. These include: medicines and therapeutic devices; road transport vehicles; building structures; pesticides and veterinary medicines; electrical consumer products; and tobacco. The Australian product safety system is designed to deal with the majority of products that are not covered by other regulators (Productivity Commission, 2006).

Several products such as fireworks, fireplace and pools which are regulated by other jurisdiction but also fall within the scope of the product safety regulator were included in this study. A detailed list of products and the inclusion and exclusion are provided in Appendix 3 and 4.

Defining safety is important in the identification of product safety issues. The definition is used to justify whether a product is ‘safe’ or ‘unsafe’ and, the way a product safety regulator defines safe and unsafe products determines the product safety approach used. The broad definition of a ‘safe’ product is a product that meets the required standard and/or has not caused harm. Conversely, an ‘unsafe’ product is any product that has caused, or is likely to cause, an injury (Organisation for Economic Cooperation and Development, 2009). In Australia specifically, the Productivity Commission adopted the definition of ‘safe’ from the European Union’s general product safety directive to outline the safety criteria for products:

> *Under normal or reasonably foreseeable conditions of use including duration and, where applicable, putting into service, installation and maintenance requirements, [the product] does not present any risk or only the minimum risk compatible with the product’s use, considered to be acceptable and consistent with a high level of protection for the safety and health of persons, taking into account the following points in particular:*
>
> 1) *The characteristic of the product, including its composition, packaging, instruction for assembly and, where applicable, for installation and maintenance;*
> 2) *The effect on other products, where it is reasonably foreseeable that it will be used with other products;*
> 3) *The presentation of the product, the labelling, any warning and instructions for its use and disposal and any other indication or information regarding the product;*
> 4) *The categories of consumers at risk when using the product, in particular children and the elderly*
>
> (Ministerial Council on Consumer Affairs, 2005)

The approaches to address unsafe products are different in many countries. Some countries like those of the European Union, the United States, Japan, Mexico, Israel and Chile use a positive standard approach in which only 'safe' products based on the general safety provision are placed in the market. This approach gives a positive *ex-ante* obligation to the producers. Other countries, like Australia and Canada, adopt the negative standard approach in which product is regarded as unsafe if it has caused any injury or fatality. This approach gives a negative *ex-post* liability to the producers. The Product Safety Enforcement Forum of Europe defines these two approaches differently. 'Reactive surveillance' is an approach to address a product safety issue after an incident has happened, resembling the *ex-post* approach. Another approach called 'proactive surveillance' is a preventative approach to investigate products through risk assessment processes prior to regulators being made aware of any issue or without any incident occurring, resembling the *ex-ante* approach (PROSAFE, 2008).

2.2 GLOBAL PRODUCT SAFETY

Product safety is an internationally recognised issue which has been expanding as the global market grows. Since ancient times, international trade has been expanding rapidly, allowing countries around the world to import and export capital, goods and services across international borders and territories. In recent years, technology has played a role with the advent of e-commerce, allowing commercial transactions to be conducted electronically through the internet. Product safety initiatives have been established in several high-income countries. These used to form part of broader consumer policies rather than standalone legislation, however as the issue grows, consumer product safety acts have been introduced as separate regulatory frameworks. This type of legislation was first introduced in Canada (Hazardous Product Act in 1969), followed by the US Consumer Product Safety Act in 1972, Japan in 1973 and Australia in 1974. In the European Union, a general product safety directive was established in 1992 following the separate introduction of laws in several countries such as Germany in 1968, France 1978 and UK in 1987 (Rogmans, 2000).

The introduction of these types of regulations however, did not address the issue of global product safety completely as standards and enforcements differ across countries. Customs authorities are limited in time and resources as well as expertise to control the expanding volume of products being transported across borders (Organisation for Economic Cooperation and Development, 2010). Thus, it is vital to initiate international cooperation to address the issue globally.

Several international organisations were set up to orient their focus on product safety issues. A committee under the Organisation for Economic Cooperation and Development (OECD) was established in the 1970s to develop policy instruments to address product safety issues (Organisation for Economic Cooperation and Development, 2010). In 2008, the committee organised a roundtable meeting in which a working party on consumer product safety was established to work on a ten-point action plan. The outcome of the roundtable meeting highlighted the importance of sharing product safety information between countries. An analytical review of existing information sharing mechanisms was carried out with the objective of improving the means of sharing information between countries. The ten-point action plan below served as a guide for the working party to improve the product safety information sharing:

SHORT-TERM ACTIONS

1) *Pool information on recalls and emergency alerts on a single website.*
2) *Develop mechanisms to co-ordinate international product safety initiatives more effectively.*
3) *Support regional and global fora: to help to i) increase understanding of domestic differences, ii) promote harmonisation of standards, iii) flag emerging issues.*

MEDIUM-TERM ACTIONS

4) *Provide web access to studies of hazards.*
5) *Provide web access to updates on regulatory activities.*
6) *Establish restricted web directory of safety experts.*

LONGER-TERM ACTIONS

7) *Reach agreement on format for injury data collection.*
8) *Pool information on product hazards on a web-based platform.*
9) *Develop confidentiality protocol for sharing research information.*
10) *Enhance international co-operation on traceability.*

(Organisation for Economic Cooperation and Development, 2010)

The International Consumer Product Health and Safety Organisation (ICPHSO) which was established in 1993, is another international organisation that aims to aid the exchange of ideas and information on health and safety issues related to consumer products. This organisation, through its membership scheme, provides a forum for government agencies from several countries, industry associations, manufacturers, retailers, testing organisations, academia and consumer advocates from around the world to discuss product safety matters. ICPHSO works hand in hand with the OECD’s working party on consumer product safety to promote collaboration amongst government and non-government agencies around the world. ICPHSO organises symposia and conferences to gather relevant organisations and agencies as well as interested individuals to exchange information about emerging product safety issues and developments around the world (International Consumer Product Health and Safety Organization, n.d.).

2.3 AUSTRALIAN PRODUCT SAFETY REFORM

The Australian product safety system was initiated four decades ago in the 1970s through the introduction of the Trade Practices Act and the establishment of the Trade Practices Commission by the Australian Commonwealth Government in 1974 (ACCC, 2014e). In 1977, the legislation was amended to include regulations on unsafe goods while also introducing an array of consumer product standards (ACCC, 2014e). Other legislation on product safety was also introduced in each state and territory around Australia. A summary of the product safety legislation timeline is outlined in Table 2-1 below.

Table 2-1 Time line of Product Safety system in Australia

Product Safety developments in Australia
1974 – Introduction of Trade Practices Act and establishment of Trade Practices Commission
1977 – Trade Practices Act amendment, to include regulation of unsafe goods and development of national consumer product standards
1986 - Trade Practices Act amendment, mandatory recalls notification to the minister, power to order compulsory product recalls
1992 – Trade Practices Act amendment, introduction of product liability regime
1995 – The establishment of the Australian Competition and Consumer Commission (ACCC) replacing Trade Practices Commission
2001 – Rise in maximum penalty for product safety provisions
2004 – Initiation of the major review of Australia’s national product safety system and laws by the Ministerial Council for Consumer Affairs (MCCA). In 2008, report of this review was released
2010 – Harmonisation of product safety regulations across Australia through cooperation between Commonwealth and state and territory regulators
2011 – Establishment of single product safety system through the Australian Consumer Law

Source: (ACCC, 2014e)

Historically, the Australian product safety system relied mainly on reactive surveillance applying a negative liability approach. This allowed producers to distribute products, but to be held accountable for any harmful effects of the products identified in the market (Organisation for Economic Cooperation and Development, 2009). Under this approach, several issues were identified in the system. A study by *‘Choice’* in 2008 revealed deficiencies in the product safety system in Australia and outlined inconsistencies in laws regulating similar types of products in different states and territories (Australian Consumers' Association & Choice Campaigns, 2008). A specific product type might be restricted by state regulation, even if other states did not restrict the product; therefore it was difficult to monitor the product's distribution. In order to eliminate this inconsistency in the system, in 2011 the Commonwealth Government implemented a national level approach to product safety regulation, the 'Australian Consumer Law' (ACL) (Australian Government, 2010a).

The ACL is a single national law replacing 20 laws in different states and territories in Australia, to provide equivalent rights and protections to consumers and to consistently enforce this regulation in all states and territories (Australian Government, 2010b). This regulation constitutes specific changes in the Australian product safety system whereby product bans, recalls and safety warning notices are issued nationally by the ACCC (Australian Government, 2010a). State and territory enforcement bodies play significant roles in implementing these regulations within each state and territory and to make reference to the ACCC on product standards (Australian Government, 2010a).

In order to make these regulations effective and responsive to current product safety issues, quality information is critical for the regulators. A centralised clearinghouse has been initiated to capture and address the information needs of the new product safety system based on the recommendation of the Productivity Commission in 2006 (ACCC, 2013a; Productivity Commission, 2006). Information relevant to product safety which has the potential to inform the clearinghouse is collected in different jurisdictions across Australia. The development of a national clearinghouse is important for equipping the product safety surveillance system to enable both 'reactive surveillance' and 'proactive surveillance'. The data captured in the clearinghouse is a critical component of product risk assessment processes in product safety regulation to identify priorities and evaluate interventions. Currently, the data stored in the product safety clearinghouse is limited to reports from the mandatory reporting scheme, from consumers and competitors as well as other reports from international and Australian recalls, media, injury data and professional literature (ACCC, 2013a).

2.4 RISK ASSESSMENT

Risk assessment is the overarching framework used in the consumer product safety field internationally. It plays an important role in the creation of product safety initiatives to maximise the outcome and improve the quality of government interventions. Risk assessment in the product safety environment is defined by the Product Safety Enforcement Forum of Europe (PROSAFE) as the '*process of identifying and estimating the risk that a product with dangerous properties poses to people*'(PROSAFE, 2008). By identifying the nature and estimating the scale of product hazards, risk assessment can assist product safety regulators to determine a suitable type of action. Therefore, it endorses effective and efficient product safety intervention.

This efficacy however, depends on the quality of the risk assessment performed. Good quality risk assessment tools can provide a more sound risk judgement based on a complete and transparent risk evaluation process (van Duijne, van Aken, & Schouten, 2008). In Europe, a working group on risk assessment was established in recognition of the need for consistent and objective risk assessment in product safety environments. This working group compiled basic principles to build a 'good quality' risk assessment tool (Rider, van Aken, van de Sman, Mason, & Chen, 2009). The principles of the risk assessment tool are as follows:

1) *Clear objectives reflecting the informational needs of decision makers and determined in an iterative dialogue between the assessors and the decision makers.*
2) *The scope and content should be based on the objectives of the assessment and best professional judgement, considering the benefits and costs of acquiring additional information before undertaking the assessment.*
3) *Responsive to the nature of the potential hazard, the available data and the decision needs.*
4) *The level of effort put into the risk assessment shall be commensurate with the importance of the decisions to be made.*
5) *Objective, systematic, structured and – as far as practically possible - evidence based.*
6) *The risk shall be characterised qualitatively and, whenever possible, quantitatively.*

7) *Explicitly describe its uncertainty and the causes of the uncertainty.*
8) *Multidisciplinary, and therefore transparent and understood by all involved and/or interested parties through their inclusion and involvement in the process.*
9) *Appropriate procedures for peer review and public participation should be used in the process of preparing the risk assessment.*
10) *Dynamic, iterative and responsive to change.*

(Rider, et al., 2009)

These principles should be incorporated in a systematic process of risk assessment which comprises three general stages: (1) Risk identification, (2) Risk estimation and (3) Risk evaluation (Figure 2-1). The steps are intended to assist risk assessors to answer the critical risk assessment questions of “what can go wrong?”, “if it does happen, what are the consequences?”, and “how likely is it that it will happen?” (PROSAFE, 2008). By solving these critical questions, the outcome of risk assessment will feed into risk management strategies, to inform decisions about appropriate actions and to reduce the risks under review.

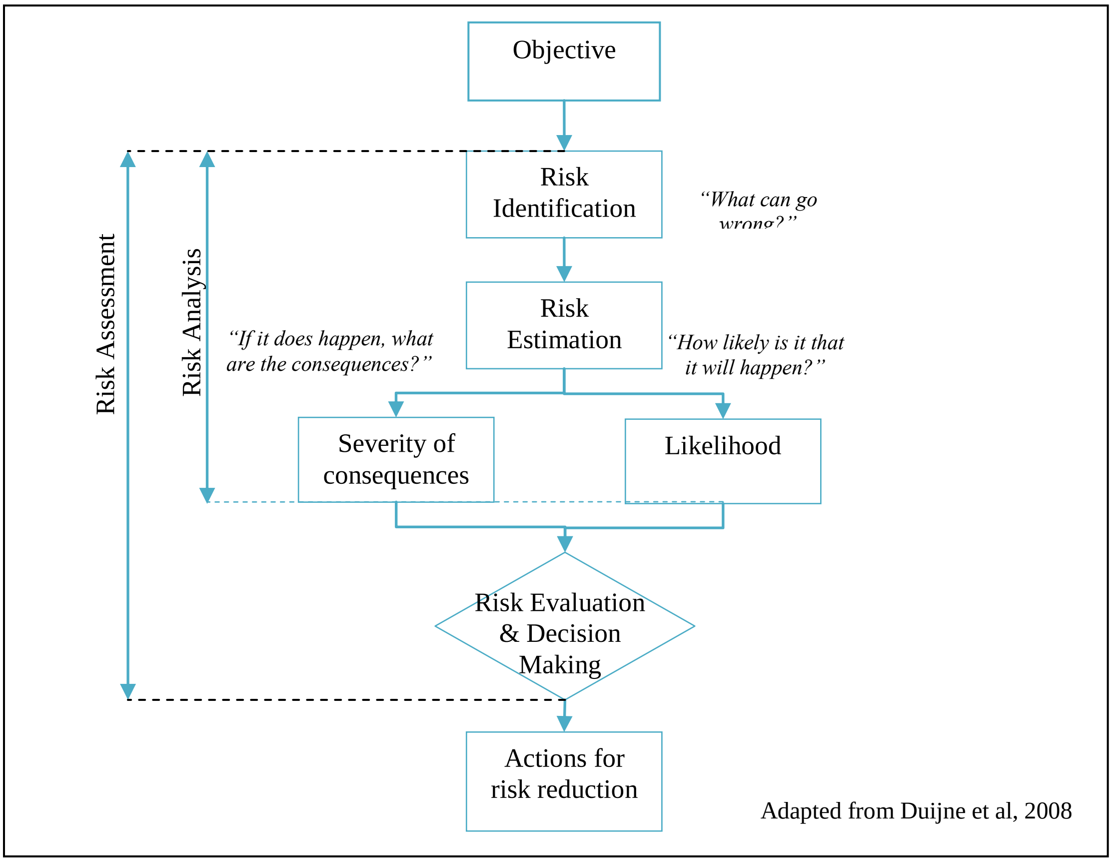


Figure 2-1 General risk assessment process

In a product safety system, data plays an important role in all stages of the risk assessment process. Firstly, the risk identification phase relies on comprehensive hazard identification to prioritise assessment efforts. This process involves the identification of all potential hazards associated with a product by specifying all possible risk scenarios to answer the question of “what can go wrong?” A risk scenario can be explained by the interaction between a person and the product or by the hazardous properties of the product (van Duijne, et al., 2008). Injury data can provide the type of injury mechanisms to indicate possible risk scenarios for the product risk assessment.

Once a potential hazard is identified, risk assessment involves an estimation of the degree of risk that is posed by the product to consumers. Risk is often measured by considering a combination of the severity of consequences and the likelihood of those consequences occurring (Ministerial Council on Consumer Affairs, 2005). In product risk assessment, the severity of consequences can be measured by assessing the seriousness of the injury caused by the product hazard. Several indicators are used to quantify the seriousness of injury, including reversibility, medical consumption, length of recovery, body part injured and fatality outcome (Rider, et al., 2009). The likelihood of injury or damage posed by a product can be measured by different indicators based on the possibility of collective risk and/or individual risk. Therefore, factors such as the availability of products in the market and individual interaction with the product should be considered (van Duijne, et al., 2008).

In answering the three critical product risk assessment questions, there are difficulties in identifying and measuring product-related risks. Risk assessors often encounter uncertainty in estimating risk in which the worst case scenario is often excessively weighted in order to avoid any risks. This excessively cautious approach can be too restrictive to the community. Another major difficulty in product risk assessment is the level of subjectivity in a) the estimation of risk and b) within the interpretation of available evidence. (Productivity Commission, 2006). The minimisation of uncertainty and subjectivity is crucial in order to ensure that the output of the risk assessment will improve the regulatory decision making.

A range of product risk assessment tools with step by step processes have been developed for product safety regulators to minimise the difficulties in risk assessment. Several examples are provided below, including the nomograph tool developed in New Zealand, the RAPEX tool used in European Union countries and the triage tool used in the Canadian product safety system.

2.4.1 Nomograph

The nomograph risk assessment tool was developed in New Zealand in 1990 (Benis, 1990) and is currently used in New Zealand. The same nomograph was also used in Australia until 2012 and some states and territories are still currently using this risk assessment tool (ACCC, 2013a). This nomograph incorporates four parameters: maximum potential injury severity, probability of hazard occurrence, hazard recognition and availability to determine the risks associated with particular products (Benis, 1990). All parameters are multiplied to obtain the calculated risk. However, the availability aspect is often bypassed due to the limited availability of information (Benis, 1990). The nomograph utilises a graphical display to assist the calculation of product risk (Benis, 1990).

The maximum potential injury represents the risk assessment question of ‘what is the consequence?’ by determining the severity rating (Benis, 1990). The severity scale categorises the potential injury into a six point scale of minor, moderate, serious, severe, critical, and death (Benis, 1990). A guideline table outlining several types of injury examples and the severity scale is used to assist risk assessors (Benis, 1990). The table was developed based on the Abbreviated Injury Scale (AIS) used internationally in the trauma field, which is aligned to the structure of International Classification of Diseases (ICD) (Benis, 1990). Age considerations are also factors that need to be considered when determining the maximum potential injury using this method.

The probability of a hazard’s occurrence represents the risk assessment question of ‘how likely is the event to occur?’ (Benis, 1990). The probability of occurrence is mapped into a six point scale of remote, unlikely, possible, probable, highly probable and almost inevitable (Benis, 1990). There is once again high subjectivity in calculating this parameter which involves considering the likelihood of product failure as well as the likelihood of unintended usage (Benis, 1990). Laboratory testing can be used to assist the determination of probability of occurrence (Benis, 1990).

Hazard recognition refers to the ability of an average adult to recognise the hazard associated with a product (Benis, 1990). Hazard recognition for children's products is considered to be the responsibility of the adult who purchased the product to ensure it is suitable for the child's age (Benis, 1990). This parameter takes into account that early recognition of product hazards will reduce the likelihood of injury (Benis, 1990). Hazard recognition is mapped into a five point scale: highly improbable, improbable, possible, probable and almost inevitable (Benis, 1990).

The last parameter of the nomograph risk assessment tool is the availability of the product in the market. This parameter is often bypassed due to limited information or if the product under assessment is not yet marketed (Benis, 1990). The scale used for this parameter includes rare, limited, general and very high (Benis, 1990). Manufacturers, retailers or importers play an important role in the input of information for this aspect of risk assessment (Benis, 1990).

There are several advantages and disadvantages related to the utilisation of the nomograph risk assessment tool. The advantage of using the nomograph risk assessment tool is that the severity categorisation of a risk's consequences is aligned to the structure of the ICD. Therefore, injury data can be easily utilised in the risk assessment process. Moreover, the assessment of severity consequences using this risk assessment tool allows consideration of vulnerable groups in the population such as children and the elderly who might be affected more severely than the rest of the population. However, while vulnerable groups are considered in the assessment of severity, they are not considered in the assessment of hazard recognition. The recognition of hazards relating to children, for example, was regarded as a carers' (average adult consumer) responsibility. A study conducted in Europe to compare different risk assessment tools, found that the nomograph risk assessment tool is best used to represent the acceptable risk to the average consumer (Floyd, Nwaogu, Salado, & George, 2006).

The nomograph risk assessment tool also has its advantages as it allows multiple assessments for multiple hazards or for population groups. However, it is also prone to a degree of subjectivity which increases the risk of inconsistency between risk assessors' outcome. There is often uncertainty in risk estimation. In order to 'play it safe', product safety regulators often err on the side of caution (Productivity Commission, 2006). The nomograph risk assessment tool can facilitate the worst-case scenario approach through the identification of the maximum potential injury severity. However, it is also argued that exercising excessive caution when using this approach can also be costly to the community (Productivity Commission, 2006).

2.4.2 RAPEX

Another product risk assessment tool was developed under the RAPEX system (Rapid Alert System for Non-Food Consumer Products), a rapid alert system that facilitates the exchange of information between European Union (EU) member states and the European Commission on product safety issues. The RAPEX risk assessment tool was initially developed as a transparent and practical product risk assessment method for product safety authorities in EU member states. However, the tool has also been adopted by other countries including, more recently, Australia (European Commission, 2010).

The framework of this risk assessment tool incorporates the product hazard and the probability of injury using a series of tables and 'event trees' to tabulate decisions and determine risk levels (PROSAFE, 2008). The product hazard component of the RAPEX tool involves step by step assessments starting with identifying the product unambiguously. This includes all specific information about the product such as the product name, brand, model, type number, country of origin, etc (European Commission, 2010).

The second step is to identify the hazard associated with the product. Hazard is defined as '*the intrinsic property of the product that may cause an injury to the consumer who uses the product'*. Several forms of hazard are identified, including mechanical hazard, choking hazard, suffocation hazard, electrical hazard, heat or fire hazard, thermal hazard, chemical hazard, microbiological hazard, noise hazard and other miscellaneous hazards. The types of hazards are outlined in the RAPEX guideline table which will be discussed later in this section. Following the identification of the product hazard, it is also important to assess the consumer groups for the product, including the intended users of the product and also the non-intended users. This is to consider that often, the non-intended user may not be capable of using the product appropriately or of recognising the hazards associated with the product (European Commission, 2010).

Once all the information about the product, product hazards and the consumer are gathered, the injury scenario can be established. The injury scenario is the step–by-step identification of how the injury happened. Following this, the severity of injury is identified using 4-point severity scale rating. The four levels of severity were developed to reflect the treatment required and consequence of the injury outlined in the table. The level of severity is determined based on: the types of hazard; the intensity of the hazards; the length of time of the exposure to the hazards; the body part/s injured; the impact on the body part/s; and the type and behaviour of the injured person (consumer). The description of each level is explained below:

- *Severity level 1 – Injury or consequence that after basic treatment (first aid, normally not by a doctor) does not substantially hamper functioning or cause excessive pain; usually the consequences are completely reversible.*
- *Severity level 2 – Injury or consequence for which a visit to A & E may be necessary, but in general, hospitalisation is not required. Functioning may be affected for a limited period, not more than about 6 months, and recovery is more or less complete.*
- *Severity level 3 – Injury or consequence that normally requires hospitalisation and will affect functioning for more than 6 months or lead to a permanent loss of function.*
- *Severity level 4 – Injury or consequence that is or could be fatal, including: brain death; consequences that affect reproduction or offspring; severe loss of limbs and/or function leading to more than approximately 10% of disability.*

(European Commission, 2010)

A RAPEX tool guideline table was developed to assist the risk assessor in determining the severity of the injury based on the gathered information. The severity level determined using the table is expected to reflect the treatment required for the type of injury associated with the product hazard outlined above. However, there is no previous study that has tested and confirmed the correspondence of the injury types in the guideline table with the severity level descriptions. Another drawback of this approach is the absence of age considerations in the guideline to account for the differences in vulnerability in different age groups. Therefore the type of injury examples can misclassify the level of treatment required or consequences of the injury.

There are several advantages and disadvantages related to the utilisation of the RAPEX risk assessment tool. Positively, the severity categories of the risk consequences are fewer than other risk assessment tools (four levels) which can ease the categorisation process and reduce the degree of inconsistency in severity ratings. However, the lower number of categories in the RAPEX methodology can also constrain the scope for risk assessors to match the risk level to the appropriate action to be taken (Floyd, et al., 2006). Moreover, while the RAPEX severity rating guideline is a useful means of assisting the categorisation process, the structure of the classifications within the guideline is slightly different to the structure of other injury classifications, making it difficult to apply RAPEX categories to injury data.

Another benefit of the RAPEX risk assessment tool is that it allows consideration of vulnerable groups in the population such as children and the elderly who might recognise product hazards differently to the average consumer and therein, might be affected more severely than the rest of the population. The study conducted in Europe concluded that the RAPEX risk assessment tool is best used under a ‘risk averse approach’ to account for vulnerable groups in the community (Floyd, et al., 2006). This is aligned with the focus of the Australian product safety regulators on child-related product safety issues.

2.4.3 CPSD Triage

The Consumer Product Safety Directorate (CPSD) in Canada uses a triage tool to assess product risks. The risk assessment process is undertaken by the Risk Assessment Bureau (RAB) who then inputs information to the Risk Management Bureau and Program Development Bureau who develops, implements and endorses the product safety initiatives (Health Canada, 2011b). The risk assessment process is the underlying process that provides the evidence-based information.

Prior to the risk assessment process, the RAB use the triage prioritisation tool in order to assess the worthiness of a product safety issue being addressed. The prioritisation tool incorporates six factors including injury severity, near-miss significance, victim age, product factors, product incident history and usage of product. A prioritisation score is calculated based on these six factors to determine action. If the score exceeds 100, a risk assessment is conducted. Injury severity is determined based on four levels: minor, moderate, serious and death, in which the description of each level is outlined below.

- *Minor – requires first aid treatment, medical attention is not necessary*
- *Moderate – temporary or remediable, the consequences are not life-threatening and are reversible in most instances.*
- *Serious – are irreversible; cause permanent disability or long-term illness*
- *Death – where death as occurred due to any of the injuries*

(Consumer Product Safety Directorate, 2012)

The risk assessment combines an evaluation of product hazard and product exposure to determine the level of risk associated with the product. The product hazard evaluation looks into the product description and how it relates to the hazard; the users of the product; the scenario of product usage; and the severity of the hazard (Ryan, 2012). Consequently, the product exposure evaluation looks deeper into the users of the product and possible vulnerable users, the forseeable route of exposure, the lifespan of the product and the identification of foreseeable scenarios of injury pathways (Ryan, 2012). The Triage risk assessment tool is advantaged by its consideration of age to account for vulnerable groups. It also allows consideration for near-misses incidents in the risk assessment.

2.5 PRODUCT SAFETY INTERVENTIONS

Based on the results of the risk assessment process, two main questions are to be answered: 1) Whether or not product safety regulators need to intervene. If yes, then; 2) What is the most appropriate action to address the issue? The outcome of product risk assessments provide a platform for the decision makers to consider regulatory action/s. Decision makers may take into account many considerations to warrant regulatory action/s. In the Australian product safety system, the product safety criteria outlined in section 2.1 are used to establish whether a product is safe or unsafe for the community. Additionally, several further considerations are taken into account to determine whether a risk is acceptable or unreasonable:

- *The nature and severity of the injury*
- *The probability of adverse outcome*
- *The size of the exposed population (Including bystanders)*
- *A risk comparison with historically acceptable risks*
- *The time period between exposure and damage*
- *The types of and the vulnerability of the likely user/s and their previous experience with similar products*
- *The extent to which the product incorporates safeguards*
- *Consumers' knowledge of the risk and/or how to control the risk*
- *Whether risks are accepted voluntarily or involuntarily*
- *Whether risks exist during intended use or unintended use*
- *The utility of the product*

(Productivity Commission, 2006)

If a risk is regarded as unreasonable, the next step in the risk assessment is risk management. Risk management aims to mitigate or to avoid the risks identified in the risk assessment (AS/NZS 4360:1999). It involves a selection process to choose one or more options for risk treatment and implementing those options (AS/NZS ISO 31000:2009). An effective product risk assessment is expected to lead to the formulation of appropriate product safety interventions that are intended to eliminate or to reduce the product hazards in the marketplace.

In addressing product safety issues, it is also important to consider the form of intervention and how it will be delivered. Seven principles of ‘good’ regulatory intervention, as outlined by The Productivity Commission (2006) suggest that regulatory intervention should be *the minimum necessary to achieve objectives; Not unduly prescriptive; Accessible, transparent and accountable; Integrated and consistent with other laws; Communicated effectively; Mindful of the compliance burden imposed; and Enforceable.* In order to meet these terms, it is important to consider the cost and benefits of an intervention.

Depending on the nature and characteristics of the product safety issue, safety interventions can be applied at any stage of the product cycle. Manufacturers, retailers, consumers and product safety regulators all play important roles in addressing product safety issues. It is argued that at the design level, manufacturers have the greatest potential to influence the safety of the product before it is released to the market (Productivity Commission, 2006). The Productivity Commission (2006) argued that when a product is in its design phase, producers ought to consider the product’s intended use and the potential for any reasonably foreseeable misuse. In many countries that apply the ex-ante approach in their product safety system, safety interventions are more extensively involved at the design level. Product safety regulators can enforce manufacturer action during the design phase as part of their monitoring of general safety provisions in order to ensure products reaching the market are deemed safe prior to their launch. For instance, in order to assist manufacturers in product design, safety standards exist to inform and direct a product’s safety requirements. These standards can be voluntary or mandatory, depending on a number of factors.

Product safety interventions can also be enacted when a product/s is already available on the market. Actions are taken when product hazards are identified in the market to recall the products from the market, to redesign hazardous features or; in cases where it is not feasible to undertake redesign, the product may be banned from distribution in the market.

There are several product safety interventions that are commonly utilised to address product safety issues in Australia. These include safety standards, information standards, warning notices, product bans, compulsory recalls and mandatory reporting. As part of the regulatory initiatives, a product liability law is also applied in Australia to address product safety issues. There are also non-regulatory approaches that can be implemented to address product safety issues including public provision of information, public education campaigns and publicly funded research (Productivity Commission, 2006).

2.5.1 Safety Standards

Product standards are widely used around the world to influence the safety of consumer products. Product standards are defined as published documents that specify the minimum requirements of a product's specifications, and outline procedures to ensure that the product can function safely for its purpose and consistently performs the way it was intended (Productivity Commission, 2006). Safety standards outline safety requirements, with particular stipulations around performance, composition, contents, methods of manufacture or processing, design, construction, finish or packaging rules (ACCC, 2014b).

In Australia, mandatory standard regulation has been utilised by the regulator to promote safety during the design and manufacturing stages of consumer products. This means that it is compulsory for the products under the regulation to be designed, produced and packaged according to the related product standard (or part of the standard) for these products to be supplied legally in Australia (ACCC, 2014b). This regulation also promotes hazard identification, risk assessment and risk management at the design and manufacturing stage (Productivity Commission, 2006).

In Australia, a total of 41 products are regulated through mandatory standards. The full list of products under mandatory standards documented below includes 16 children's products and 8 general products that are regulated due to the associated hazards posed to children. There are also other standards in place that are voluntarily utilised in Australia to define quality and safety criteria for products. However, it is still legal to supply products that do not meet voluntary standards.

- Aquatic toys
- Baby bath aids
- Baby dummies
- Balloon blowing kits
- Basketball rings and backboards
- Bean bags
- Bicycle helmets
- Bicycles (pedal bicycles)
- Blinds, curtains and window fittings
- Bunk beds
- Care labelling for clothing & textiles
- Child restraints for use in motor vehicles
- Cigarette lighters (disposable)

- Cigarettes (reduced fire risk)
- Cosmetics—ingredients labelling
- Cots (household)
- Fire extinguishers (portable, aerosol)
- Exercise cycles
- Cots (portable, folding)
- Fire extinguishers (portable, non-aerosol)
- Hot water bottles
- Jacks (trolley & vehicle)
- Luggage straps (elastic)
- Motorcycle helmets
- Nightwear for children
- Portable swimming pools
- Prams and strollers
- Ramps for motor vehicles (portable)
- Recovery straps for vehicles
- Soccer goals (moveable)
- Sunglasses & fashion spectacles
- Support stands for vehicles
- Tobacco health warnings
- Swimming and flotation aids for water familiarisation and swimming tuition
- Toys (projectile)
- Toys and finger paints containing lead and other elements
- Toys containing magnets
- Toys for children up to and including 36 months of age
- Treadmills

(ACCC, 2014b)

2.5.2 Product Bans

Product bans aim to completely eliminate product hazards in the market. A ban on a product means that it is illegal for anyone in trade or commerce, to supply, offer to supply, manufacture, possess, or have control of the product (ACCC, 2014c). In Australian product safety systems, there are two types of product bans: interim bans and permanent bans (ACCC, 2014c). The interim ban is a temporary ban administered by the product safety regulator at national or at state and territory levels to protect the community from a suspected dangerous product in the market. It is often an initial step to establish a permanent ban while the government is investigating the risk associated with the product (ACCC, 2014c). A permanent ban is established if the product risk is proven to be harmful to the community and it outweighs the benefits of the product being sold in the market (ACCC, 2014c). In Australia, permanent bans are administered at the national level only by the Commonwealth Government (ACCC, 2014c). This is to ensure that the regulations are applied in all states and territories (ACCC, 2014c). There are currently 22 products banned by the Australian Government (See Table 2-2). The majority of these products were banned due to the associated hazards posed to children.

Table 2-2 Australian Product Bans

Product bans	Date	Hazard
Baby dummies with unsafe decorations	9 September 2011	Choking, ingestion and inhalation
Baby dummy chains with unsafe decorations	9 September 2011	Choking, ingestion and inhalation
Candles with lead wicks	October 2002	Lead poisoning
Combustible candle holders	1 February 2011	Burns, serious injury or death
DEHP in children’s plastic items	1 February 2011	Adverse effects on children
Fire footbags and other such goods	25 January 2010	Serious burns
Gas masks with asbestos breathing devices	15 September 1993	Terminal cancer
Glucomannan in tablet form	22 December 1986	Choking and suffocation
Magnets – small, high powered	15 November 2012	Serious injury or death from ingestion
Mini jelly cups containing konjac	21 April 2004	Choking
Miniature motorbikes (monkey	1 February 2011	Serious injury or death from accidents

Product bans	Date	Hazard
bikes) with unsafe design features	20 August 2011	and mechanical flaws
Novelty cigarettes	1 February 2011	Respiratory tract irritation and inflammation or lung, skin and ovarian cancer
Pools and spas with unsafe design features	1 February 2011	Serious internal injuries or entrapment of body parts and hair from the strong suction
Sky lanterns	1 February 2011	Uncontrolled fire
Smokeless tobacco products	4 June 1991	Cancers, chromosomal damage, infections and death
Tinted headlight covers	7 May 2003	Serious injury or death from accident
Tongue studs without holes	1 July 2010	Internal lodgement
Toothpaste containing Diethylene glycol (DEG)	12 March 2009	Serious illness from DEG poisoning
Toy-like novelty cigarette lighters	1 February 2011	Burns
Toys containing beads (inflatable, novelty & furniture)	1 February 2011	Suffocation or respiratory illness and infections
Undeclared knives or cutters in stationery sets	1 February 2011	Laceration and puncture wounds
Yo-Yo water balls	1 February 2011	Strangulation or adverse reactions from swallowing the liquid

Source: Product safety Mandatory standards and bans (ACCC, 2013b)

2.5.3 Product Recalls

Product recalls aim to remove unsafe products from the market and attempt to recover or make safe the products, which have already been sold. Product recalls are normally undertaken by businesses voluntarily though they may also be mandated by the government. The process allows consumers and/or retailers to return the recalled product to the supplier to be repaired, exchanged or refunded. The Australian Government provides a guideline to assist businesses in undertaking voluntary product recalls. However, the product safety regulator also has the power to mandate product recalls if there is suspicion that the product is unsafe and/or there is an issue in a recall process (Productivity Commission, 2006). Product recalls may initiate the process for unsafe products to be regulated by the government through product bans, the introduction of mandatory standards, or other regulatory actions.

There are several limitations associated with product recalls. While it can be an incentive for businesses to avoid product liability laws and loss of reputation, product recalls can still be costly (Productivity Commission, 2006). Therefore it is important for businesses to ensure that products are safe before they are marketed. Additionally, the effectiveness of product recalls in retrieving unsafe products cannot be guaranteed if there is only small proportion of sold recalled products returned to the suppliers. Based on the latest product recall system review conducted by the ACCC, the average of return rates of recalled products ranged between 36% and 80%. Return rates are influenced by many factors including the type of product, the methods of communicating the recall, the hazard associated with the recalled product and the level of regulatory involvement in the process.

An effective product recall process consists of several aspects including notifying the regulator of a recalled product, communication of the recall/s to consumers, retrieval of the recalled product and closure of the recall. The review conducted by the ACCC found that the recall process was shown to be more effective with greater government involvement throughout all aspects of the recall process (Australian Competition & Consumer Commission, 2010).

2.5.4 Mandatory reporting

Mandatory reporting is an initiative to improve the identification of product hazards by enforcing the notification of product-related incidents to the regulator. The Australian Government has recently adopted the mandatory reporting initiative through the establishment of the ACL in Australia in early 2011. This method was intended to accelerate the sharing of information in the Australian product safety system to improve its ability to identify and respond to emerging product safety issues (ACCC, 2010). Under this regulation, there is an obligation for businesses to report any product-related death, injury and illness within two days of becoming aware of the incident. The mandatory reporting regulations apply to all participants in the supply chain of a consumer product or service. This includes the retailer, dealer, distributor, installer, repairer, importer, manufacturer and/or exporter of consumer products. (ACCC, 2010). Reporting can be done through an online form on the product safety website or by phone call (ACCC, 2014a).

The implementation of mandatory reporting alone is not sufficient to effectively identify product-related hazards in the market. The obligation to report product-related incidents only covers cases that fall under the definition of serious injuries and fatalities: *"an acute physical injury or illness requiring medical or surgical treatment by, or under the supervision of, a qualified doctor or nurse"* (ACCC, 2010). By this definition, other product-related near-misses and non-serious injuries that can potentially indicate product hazards in the market are not required to be reported. In order to address this, the ACCC also allows voluntary reporting of product-related incidents that are not classified under the above definition.

2.5.5 Product Liability

The product liability arrangements which have constructed the *ex-post* characteristics of the Australian product safety system provide avenues to enforce product safety through the legal system in Australia. The product liability regime was first introduced in Australia in 1992 allowing consumers to seek compensation from manufacturers for injury, loss or damage caused by the product they supplied (Productivity Commission, 2006). This regime can be costly to businesses in Australia and thus, it provides negative enforcement, or conversely, an incentive for businesses to supply safe products.

Since the establishment of the ACL in 2011, the regulator has also implemented *ex-ante* approaches to positively enforce product safety. For example, the implementation of mandatory standards for several types of product as well as the enforcement of General Safety Provision (GSP) to only market safe products. Section 54 of the ACL covers consumer guarantees relating to the supply of goods, where an acceptable quality of a product is defined as:

> *(a) fit for all the purposes for which goods of that kind are commonly supplied; and (b) acceptable in appearance and finish; and (c) free from defects; and (d) safe; and (e) durable; as a reasonable consumer fully acquainted with the state and condition of the goods (including any hidden defects of the goods).*

(Competition and Consumer Act 2010 (Clth) s.54, 2010)

This means that if a product in the market was determined to be unsafe, actions could be taken against the producer or supplier of the product. Other product safety initiatives that have been outlined above also provide assistance for businesses to avoid liability due to unsafe products.

2.6 DATA NEEDS

In the risk assessment intervention and evaluation process, data plays a vital role in providing evidence-based information. Even though there are many types of product risk assessment tools, the data needs to perform risk assessments which are similar. The core inputs of risk assessment processes include specific data items such as product details, types of consumer, hazard posed, injury scenario, injury severity and probability estimates (McKenzie, Scott, Limbong, & Li, 2011). Data may be sourced from various government and non-government agencies. A study by Choice recognised the inconsistency in data collection in these data sources (Australian Consumers' Association & Choice Campaigns, 2008) where the types and characteristics of data differed according to the objectives and orientation of the collecting organisations.

Several types of information currently available as part of the product safety system are product recalls, product testing results, reports on market surveillance, emerging product safety hazards, product bans and standards, and product-related injuries from other jurisdictions. All data items required to predict the level of risk associated with a product are extracted from the available sources of information.

Table 2-3 Existing Product Safety Information in Australia

Available Information	Source of information	Data items
Product recalls	Manufacturers, Industry associations, retailers and Product safety regulators	Product details, hazard posed, probability estimates
Product testing results	Testing organisations	Product details, hazard posed
Reports on market surveillance	Product safety regulators, market surveillance organisations	Product details, hazard posed, type of consumer, probability estimates
Emerging product safety hazards	Consumer advocates, injury surveillance	Product details, hazard posed
Product bans	Product safety regulators	Product details, hazard posed
Product standards	Product safety regulators	Product details, hazard posed
Injuries	Hospitals, ED-based injury surveillance, death review team, other healthcare data sources.	Injury scenario, injury severity

Source: (Organisation for Economic Cooperation and Development, 2010)

Given the diversity of data types and sources, information sharing between agencies and organisations, as well as between countries, is vital in the product safety system. Similarly in Europe, a recommendation has been made to promote monitoring procedures which include data collection measures for product specifications and customer complaints to assist the market surveillance program (European Commission Health and Consumer Protection Directorate General, 2004). At the international level, as explained in Section 2.2, the OECD’s committee on consumer policy is also working to improve methods of sharing information about emerging product safety issues between OECD and non-OECD countries. As part of this work, a web-based global injury data portal that pools domestic data from multiple jurisdictions is currently being developed by the OECD’s Working Party on Consumer Product Safety (Organisation for Economic Co-operation and Development, 2014). Information sharing on product-related injuries, however, is more complicated than the sharing of other types of product safety information as it often involves accessing confidential information about individuals’ health. These issues will be discussed further in later chapters.

2.7 PRODUCT SAFETY FOCUS ON CHILDREN

Product safety regulators in Australia have concentrated primarily on intervening on products which pose hazards to young children. This is due to the number of product-related injuries being more prominent amongst children. This is also demonstrated in the Queensland Injury Surveillance Unit (QISU) data which showed a higher proportion of product-related injuries occurred among children aged 0 -17 years old, accounting for 37% of all reported injuries, compared to 26% of injuries amongst consumers 18 years or older (See Appendix 1).

The latest review of the Australian product safety system conducted by the Productivity Commission highlighted the importance of taking into account vulnerable groups, including children and the elderly in the consideration of product safety risks (Productivity Commission, 2006). Since the launch of the Australian Consumer Law in early 2011, there has been an increase in children’s product regulation. Currently, almost half (11 product bans) of the banned products across all ages in Australia are associated with hazards to children, with 6 of these product bans applied after the launch of the ACL (ACCC, 2013b). The recent adoption of the RAPEX risk assessment tool, which allows the risk assessor to account for the vulnerable groups, also highlights the concentration of product safety initiatives to reduce product-related injuries in children.

2.8 CHAPTER SUMMARY

In summary, product safety systems both internationally and in Australia are designed to protect consumers from potential product hazards and to minimise the cost of product related injuries while also seeking to address market failure. As the global market grows, product safety initiatives have been established in many countries to address expanding product safety issues. As this issue develops, product safety legislations evolve from being part of broader consumer policies to becoming standalone legislation. The Australian product safety system has undergone several reformations since it was established four decades ago. The major reformation was to consolidate the laws in states and territories to a single national law in order to eliminate the inconsistency in product safety legislations.

Product risk assessment is the overarching framework used in the consumer product safety field both internationally and in Australia. Risk assessment tools are used to maximise the outcome and improve the quality of product safety initiatives, with data playing a vital role in providing evidence-based information for performing product risk assessment. Injury data are one of the most crucial data needs to support the risk assessment processes, however, there are challenges in the utilisation of injury data to support the product safety system. The next chapter will discuss the history, framework and approaches to injury surveillance more broadly.

Chapter 3: Literature Review – Injury Prevention and Injury surveillance Systems

Chapter 3: Literature Review – Injury Prevention and Injury surveillance Systems

In order to support the product safety system in Australia, an integrated system that addresses the data needs of regulators is required. As discussed in Chapter Two, injury data is one of the most vital data needs to support the product safety system. Potential injury data sources are available at state and national levels to construct an integrated product safety surveillance system. However, gathering national injury data for product safety purposes can be a challenging process due to their often complex structures and formats as well as the extensive process required to gain access to these data. This chapter will discuss the theoretical framework and the characteristics of injury prevention and the injury surveillance systems in Australia to provide a broader context to the product safety case.

3.1 INJURY PREVENTION

The concept of injury prevention is a relatively recent phenomena compared to other areas of public health. However, injury prevention practices started even before the concept itself was invented. In ancient times, people instinctively tried to protect themselves from harm by designing tools to kill wild animals and used amulets for protection (Baker, 2000; Pearn, Nixon, & Scott, 2004). The scientific approach toward injury prevention was started by the adoption of the conceptual framework developed by William Haddon in 1972. This concept leads to a better understanding of the transfer of the energy phenomenon that occurs in injury incidents which formed the foundations for more elaborate research in the injury prevention field.

The concept developed by William Haddon in 1970 was focussed on identifying and understanding four factors which he included in what is now known as Haddon's Matrix (Figure 3-1). These four factors are 1) the host (i.e. the person injured); 2) the agent (i.e. the force or energy – such as thermal, mechanical etc); 3) the vector (i.e. the person or thing that applies the force); and 4) the environment (i.e. the situation or conditions under which the injury happens) (Stevenson, Ameratunga,

& McCLure, 2004). The conceptual framework outlined in the Haddon's matrix is a useful tool to understand the injury chain and the transfer of energy between the factors. The cause of injury can be easily established with a complete understanding of how the injury occurs. Identification of the cause of injury is the key in the process of determining the appropriate action to prevent the injury.

Haddon's Matrix[a]

	Human (or host)	Vector	Physical environment	Socio-economic environment
Pre-event	Is host pre-disposed or overexposed to risk?	Is vector hazardous?	Is environment hazardous? Does it have hazard-reduction features?	Does environment encourage or discourage risk-taking and hazard?
Event	Is host able to tolerate force or energy transfer?	Does vector provide protection?	Does environment contribute to injury during event?	Does environment contribute to injury during event?
Post-event	How severe is the trauma or harm?	Does vector contribute to the trauma?	Does environment add to the trauma after the event?	Does environment contribute to recovery?

[a] The terms used in the table are modified versions of the terms originally used by Haddon. Source: Haddon (7)

Extracted from World Health Organisation injury surveillance Guidelines. (World Health Organisation, 2001).

Figure 3-1 Haddon's matrix

Following the development of Haddon's Matrix as a tool to assist researchers in understanding injury events, Susan Baker in 1972 proposed the three "E's" to prevention approaches: 1) Education; 2) Ergonomics, engineering and design; and 3) Enforcement (Pearn, et al., 2004). The first E, Education, is a prevention approach to promote safety through public awareness campaigns utilising media and personal advocacy (Pearn, et al., 2004). The ergonomics, engineering and design approach is to prevent injuries by modifying the environment or equipment (Pearn, et al., 2004). Building safer roads to prevent road traffic accidents, smoke alarms installation and creating flame-resistant nightwear to prevent injuries from fire, and barrier installation to prevent falls are some the examples of this design prevention approach. The last prevention approach, enforcement, refers to the use of legislation to enforce safety (Pearn, et al., 2004).

In addition to the three approaches above, injury prevention can also be classified into three intervention types depending on the specific aim of the strategy. Primary prevention aims to prevent the likelihood of injury. Secondary prevention aims to provide early detection of injury. Tertiary prevention aims to reduce the likelihood of disability and prolonged sequelae from the injury (Stevenson, 2004). Based on these three aims, injury prevention is defined as 'actions taken to decrease the frequency of injury events and forestall an injurious outcome, the early recognition and management of an injury, and the avoidance of adverse consequences following injury' (Stevenson, 2004).

The implementation of injury prevention actions follows a step by step process which involves researchers and regulators. A public health framework which involves a four stage model is commonly used in the injury prevention field to guide an effective injury prevention program. The four stages of this model consist of 1) defining the problem; 2) identifying causes; 3) developing and testing interventions; and 4) implementing effective intervention programs (Sleet, Hopkins, & Olson, 2003). Injury data play an important role in providing evidence-based information in each stage of this model.

Following scientific developments in the injury prevention field through the adoption of Haddon's framework, the development of prevention strategies and the four stage model, the injury prevention field has grown extensively to cover many areas of injury. The scientific approach was first adopted to examine road traffic injuries which then expanded to other new areas of injury prevention research such as self-harm injuries; fall-related injuries; poisoning; and drowning. Consumer product-related injuries are often examined in relation to the mechanism of injuries (i.e. falls from objects, drowning while using devices, etc).

3.2 INJURY SURVEILLANCE

Injury surveillance systems are critical to injury prevention to provide the evidence base for identification, prioritisation, response and evaluation. Surveillance is defined by the World Health Organisation (WHO) as "the ongoing and systematic collection, analysis, interpretation and dissemination of health information which involves the keeping of records on individual cases, assembling information from those records, analysing and interpreting this information, and reporting it to others"

(Holder et al., 2001). Specifically in the injury prevention field, surveillance means a continuing collection of data on the occurrence of injury that will be used in prevention activity (Driscoll, Harrison, & Langley, 2004b). Injury surveillance provides population-based data to inform the magnitude and scope of problems. Injury surveillance can provide data to describe the size and characteristics of injury patterns, the populations at risk, the risk factors and trends over time (Holder, et al., 2001). This information provides input into the process of defining problems and identifying causes of injuries. Injury surveillance systems at any level (national, state or local) also assist in explaining the burden of injuries, emerging hazards and the effectiveness of injury prevention programs (Warda, 2003). Therefore, injury surveillance systems are crucial to inform evidence-based planning and resource allocation in injury prevention as well as healthcare.

There are two types of injury surveillance systems. Firstly, active surveillance detects injury cases and investigates the cases through interview and follow-up (Holder, et al., 2001). This type of surveillance, however, requires significant expenditure on human and other resources. Secondly, passive surveillance collects relevant information from existing routine data collections, compiled for other purposes, such as emergency departments, death certificates and medical insurance claims (Holder, et al., 2001). The second type of injury surveillance system is the most common in many countries. However, the data collected for passive surveillance may not be designed to meet all the needs for injury data for injury prevention purposes.

Well-constructed injury surveillance systems with reliable information can help improve the efficiency and effectiveness of injury prevention and health promotion programs by providing information on risk factors. In order to achieve this, information specific to the areas of concern is required (Holder, et al., 2001).

Another important potential of injury surveillance systems is to allow data to be shared across different agencies. This contributes to increased efficiencies and cost minimisation for injury information management. Data stored and managed in the surveillance units can be analysed and shared by multiple government agencies for different purposes. Using injury data to support product safety initiatives is one purpose that can be served by data sharing.

There are several criteria for an effective injury surveillance system. Ideally, an injury surveillance system is required to allow three functions: data collection, data analysis and data dissemination to prevention programs (Warda, 2003). Based on these aspects, injury surveillance systems are assessed in terms of three core characteristics: data quality, operational and practical characteristics (Mitchell, Connor, & Williamson, 2009). The data quality characteristics are assessed based on several criteria including data completeness, the ability to correctly detect injury and non-injury cases (specificity and sensitivity) and the representativeness of the data to provide accurate representation of injury distribution. The operational characteristics are assessed based on the purpose and objectives of the system, data collection process, case definition, timeliness, uniform classification systems, quality control measures and system security. Lastly, the practical characteristics are assessed based on data accessibility, usefulness, routine data analysis and guidance material to aid data interpretation.

The implementation of an effective injury surveillance system that meets the above criteria however is often confronted by several common barriers. Firstly, it is almost impossible to collect data from all injury cases in the population due to the large number of cases (Driscoll, et al., 2004b). In order to make data collection for injury surveillance purposes attainable and affordable, data are often collected through sampling methods. However, using this method is subject to sampling bias. In injury surveillance for instance, injury data collection may only include the more severe cases that require treatment in an emergency department (Driscoll, et al., 2004b).

Another common barrier in injury surveillance systems is the lack of denominator availability. In order for an injury surveillance system to effectively provide an accurate estimation of injury incidence rates, it is not only important to identify the numerator, which is the number of related injuries, but also the denominator which is the total number of people at risk (Driscoll, et al., 2004b). Incidence rates are often calculated based on person-time exposure, which is the number of individuals exposed to a certain risk and the corresponding duration of exposure (Indrayan & Sarmukaddam, 2001). In injury data, calculating the incidence rate is often restricted by the unavailability of data on person-time exposure. Specifically, in product-related injuries, it is frequently difficult and/or not possible to calculate incidence rates due to the number of products available in market and the aforementioned unavailability of person-time exposure.

The focus of an injury surveillance unit is often concentrated on the numerator and an estimated population is often used as the denominator (Driscoll, et al., 2004b). Bangdiwala (2000) argued that in order to accurately calculate area-specific rates, "the numerator and denominator must properly account for residency and transient status to properly measure the exposure risk". This method is appropriate for use if the injury data are collected from the entire population, but this is often challenging to do when injury data collections are based on a sample of a given population, as accounting for residency and transient status within a subset of the population possesses its own limitations.

Timeliness is another common issue related to injury surveillance. As highlighted above, the ideal time to collect, analyse and disseminate injury data is daily to monthly (Mitchell, et al., 2009). However, this timeframe is often difficult to achieve as it can be expensive and labour-intensive.

Privacy issues are another consideration in releasing and linking injury surveillance data. It is often challenging to weigh individual patients' rights to privacy against public interests (Driscoll, et al., 2004b). Privacy legislations have been developed to protect the privacy of individuals. However, in Australia, the Privacy Act 1988 also allows the handling of health information for health and medical research purposes in certain circumstances, where researchers are unable to seek individuals' consent (Office of the Australian Information Commissioner, n.d.). The act enables the National Health and Medical Research Council to issue guidelines for researchers that outline the procedures for handling health information and the requirements in the conduct of research (Guidelines Under Section 95 of the Privacy Act 1988 (Clth), 2000).

3.3 INTERNATIONAL INJURY SURVEILLANCE

Injury surveillance systems have been developed in many countries throughout the world. Several injury surveillance systems are integrated or partially integrated with the product safety system. For example in the US, the National Electronic Injury Surveillance System (NEISS) is an integrated surveillance system administered directly by the US product safety regulator (Divsion of Hazard and Injury Data

Systems, 2000). Other examples of surveillance systems that are partially integrated with the product safety system are the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) in Canada (Public Health Agency of Canada, 2009b) and the European Injury Database (IDB) which collates data from several European Union member countries (Ward & Healy, 2008).

3.3.1 National Electronic Injury Surveillance System

The National Electronic Injury Surveillance (NEISS) is an injury data collection system developed in 1971 in the US to support the Bureau of Product Safety which then became the Consumer Product Safety Commission (CPSC) in 1973 (Division of Hazard and Injury Data Systems, 2000). NEISS is a probability sample of all hospitals with emergency departments in the U.S. and its territories. The system collects data from a sample of approximately 100 emergency departments to represent more than 5000 emergency departments in the US (Division of Hazard and Injury Data Systems, 2000, Schroeder & Ault, 2001, Productivity Commission, 2006). The sampling of hospital EDs was done based on the size of the hospitals (small, medium, large and very large) and the type of hospital (i.e. paediatric) (Division of Hazard and Injury Data Systems, 2000, Schroeder & Ault, 2001, Productivity Commission, 2006). The number of sample hospitals has been increased in the past 40 years to reflect more of the distribution of all emergency departments in the US (Division of Hazard and Injury Data Systems, 2000). Furthermore, in 2000, the CPSC and the Centers for Disease Control (CDC) through their sub-division, the National Center for Injury Prevention and Control jointly funded an initiative to expand NEISS data collection, broadening their focus from only product-related injuries to cover all injuries (Division of Hazard and Injury Data Systems, 2000).

NEISS adopts two types of surveillance systems through the four levels of product-related injury surveillance. Passive surveillance is conducted by utilising level 1 and 2 data obtained through ongoing routine data collection (level 1) and special surveillance of injuries treated in emergency departments (level 2). Level 1 data collection involves ongoing surveillance in which basic surveillance data items are extracted and coded using the NEISS coding manual by a NEISS coordinator in each hospital. The source documents for the coding are the medical records, and data is transmitted daily to the NEISS system. The level 2 data collection is to extract additional data items for special studies (Division of Hazard and Injury Data Systems, 2000).

The active surveillance is conducted with level 3 and 4 data collected through follow-up telephone interviews and on-site investigations (Division of Hazard and Injury Data Systems, 2000). In special circumstances, further investigations are required to establish product causation, not just product involvement, in the injury event. The investigations are conducted through telephone follow up with the victim or witness (level 3) to gather information about the injury circumstances, or through on-site visit to the place of injury occurrence to gather information relating to the site (i.g. site measurement, photographs, etc) (Division of Hazard and Injury Data Systems, 2000).

NEISS data consists of coded and text narrative data. The NEISS coding system allows injury diagnosis, body part, injury intent, incident location and other demographic information to be coded using the coding rules outlined in the NEISS coding manual. The main component of the coding system is the product codes (U.S. Consumer Product Safety Commission, 2014a). These product codes are regularly revised and updated (U.S. Consumer Product Safety Commission, 2014b). NEISS coordinators are allowed to assign temporary product codes for products that cannot be found in the product codes list (U.S. Consumer Product Safety Commission, 2014a). This function can allow new product hazards to be detected early by the consumer product safety commission.

NEISS data has been used to inform the implementation of many specific product safety regulations, promotions, and research. The database possesses statistical properties that measure the magnitude of a problem through national estimates using the systematic sampling and analysis (US Consumer Product Safety Commission, 2001). These national estimations of product-related injury prevalence play a role in raising consumer awareness in promoting product safety. NEISS data are routinely used to provide information on the number and types of injuries associated with specific hazard patterns. This information is then used by government to regulate both voluntary and mandatory standards (Division of Hazard and Injury Data Systems, 2000).

NEISS data have also been used extensively for non-governmental injury research. This extensive use can be attributed to the accessibility of the data and the availability of tools to analyse the data. A research guide was published on the NEISS website to assist NEISS data analysis (Divsion of Hazard and Injury Data Systems, 2000). The coding manual for the NEISS data is also available online to facilitate the interpretation of NEISS data (U.S. Consumer Product Safety Commission, 2014a). Furthermore, an automatic online query builder is available on the NEISS website to provide injury estimates based on the search criteria input (U.S. Consumer Product Safety Commission, n.d.).

The NEISS is currently used as a model product safety surveillance system in many countries, including Australia. In the latest review of the Australian product safety system, the Productivity Commission highlighted the opportunity of adopting the NEISS model to improve the Australian product safety surveillance system (Productivity Commission, 2006). Member countries of the OECD product safety working group are also adopting the NEISS as a model to build a global injury data portal (OECD, 2004).

3.3.2 Canadian Hospitals Injury Reporting and Prevention Program

The Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) which was formerly known as the Children's Hospitals Injury Reporting and Prevention Program is a national computerized injury surveillance system that collects injury data from emergency departments in Canada (Mackenzie & Pless, 1999). CHIRPP was initially set up in 1990 as a program for the injury and child maltreatment division under the Public Health Agency of Canada, an agency administered by Health Canada (Public Health Agency of Canada, 2009a). The name change occurred after the inclusion of general hospitals in the data collection in 1992 (Mackenzie & Pless, 1999). CHIRPP collects data from 10 paediatric hospitals and 4 general hospitals in Canada (Huchcroft, McGowan, & Mo, 2013).

The initiation and development of the surveillance system was originally inspired by a similar program that was developed in Australia called the National Injury Surveillance and Prevention Program (NISPP) (Mackenzie & Pless, 1999). The software, coding system and data collection form used in early days of CHIRPP was adopted from the NISPP system under the Australian Minister of Health's authorization (Mackenzie & Pless, 1999).

CHIRPP's injury data collection is similar to the NEISS system as CHIRPP staff are placed in emergency departments to conduct the data collection. In the CHIRPP system however, injury information is collected using a questionnaire form which is completed by the patient or caregiver and the emergency department's staff. The completed forms are then sent monthly to the Public Health Agency of Canada to be entered into the electronic system (Public Health Agency of Canada, 2009a).

The use of CHIRPP data to support product safety initiatives in Canada is conducted through collaborative work between the Public Health Agency which hosts the surveillance system and the Canadian Consumer Product Safety Directorate which also sits under Health Canada (Health Canada, 2011a). In 2009, a report on consumer product-related injuries to children and youth was released by the Public Health Agency of Canada in collaboration with Health Canada and Safe Kids Canada. The report used the full period of 1990 to 2007 CHIRPP data as well as additional mortality and hospital admission data from Statistics Canada and the Canadian Institute for Health Information (Canada, 2009). The Public Health Agency of Canada also periodically releases injury reports on specific types of products, such as baby gates, baby walkers, trampolines, bicycles and other types of products (Public Health Agency of Canada, 2012).

In order to improve the surveillance system to support product safety purposes, in 2011 the surveillance system was modified to implement a web-based data entry process allowing more hospitals to participate (Evaluation Directorate, 2013). The Public Health Agency of Canada also collaborates with the Canadian Coroner and Medical Examiner Database (CCMED) to enrich product-related injury surveillance support to the Consumer Product Safety program (Evaluation Directorate, 2013).

3.3.3 European Injury Database

The European Injury Database (IDB) formerly known as the Injury Surveillance System (ISS) or the European Home and Leisure Accidents Surveillance System (EHLASS) is an injury surveillance system which collates injury data from approximately 100 hospitals in 26 European Union (EU) member countries (European Association for Injury Prevention and Safety Promotion (EuroSafe), 2013a). The IDB, which was set up in 1999, is hosted and co-funded by the Directorates-General of Health and Consumers (DG Sanco) of the European Commission in order to provide central access to the data while the management of

IDB projects is maintained by the European Association for Injury Prevention and Safety Promotion (EuroSafe) (Directorate General Health & Consumers, n.d.; European Association for Injury Prevention and Safety Promotion (EuroSafe), 2013a, 2013c).

The main purpose of the initiation of this injury data collection was to facilitate injury prevention policies and programmes in European countries at the union as well at country level (European Association for Injury Prevention and Safety Promotion (EuroSafe), 2013a). In order to improve its function, the database has undergone several major changes in the past 14 years. A Joint Action on Monitoring Injuries in Europe (JAMIE) project is the most recent development organised by EuroSafe to improve the exchange of data and affordability of injury data collection by implementing a new common system in all participating countries (Rogmans, 2012). The project, which was commenced in 2011 through joint endorsement by 22 EU member countries, is funded by the European Commission's DG Sanco (Rogmans, 2012).

Prior to the implementation of the new JAMIE system, IDB utilised the EHLASS V2000 coding system which was initially designed to collect home and leisure accident data (European Association for Injury Prevention and Safety Promotion (EuroSafe), 2013c, 2013d). The new system that is being developed through the JAMIE project is expected to include all injuries in the IDB data collection. The system consists of two level of data collection: a Minimum Data Set (MDS) and a Full Data Set (FDS) using a coding system which was adopted from the International Classification of External Causes of Injuries (ICECI) (European Association for Injury Prevention and Safety Promotion (EuroSafe), 2013c). The MDS level, which consists of 18 data elements and a text narrative field, is the new model that is being implemented to simplify the data collection (European Association for Injury Prevention and Safety Promotion (EuroSafe), 2013d; Rogmans, 2012). The FDS level includes an additional five modules for specific types of injuries and object/substance coding (European Association for Injury Prevention and Safety Promotion (EuroSafe), 2013b). In addition to increasing the data collection coverage by simplifying the data collection, the JAMIE project is also oriented to improve the injury data to support policy development, research and prevention programs relating to violence, road accidents and product-related injuries (Rogmans, 2012).

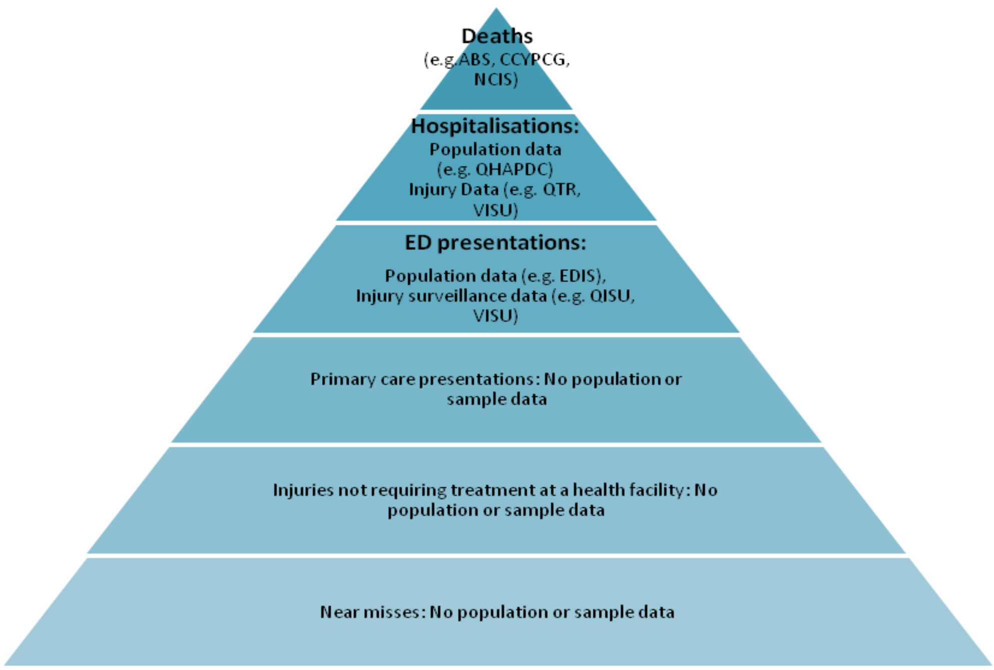
The potential for injury data to support product safety initiatives has been recognised since the early days of the ISS/EHLASS database. A preventative product safety analysis on ISS/EHLASS data was conducted by the Institute Sicher Leben (Austrian Institute for Home and Leisure Safety) in 2000 to evaluate the potential of injury data for product safety purposes (Bauer & Sector, 2000). The project, which was funded by the European Commission as part of the Injury Prevention Program, concluded that the product information stored in the ISS/EHLASS database were useful to support product safety monitoring in the EU countries (Bauer & Sector, 2000). The project also outlined several limitations that could potentially restrict the use of ISS/EHLASS data for product safety purposes such as the lack of product definition, inconsistent product coding and limited accident descriptions in the narrative data to allow causality and preventability assessment (Bauer & Sector, 2000). In order to address these issues, several recommendations were made. These included the introduction of product definitions to allow products to be flagged in the data, the application of Product Involvement Factors (PIF) to allow causality assessment and standardisation of text narrative descriptions (Bauer & Sector, 2000). Some of these recommendations were delivered in the current JAMIE project through the inclusion of an object/substance variable as part of the core IDB data elements (Rogmans, 2012).

The European Injury Database (IDB) is an example of data sharing which incorporates injury data from different sources in twelve European Union countries (Kisser, Latarjet, Bauer, & Rogmans, 2009). This initiative allows product safety agencies in different countries to share information. This information may include new regulations and actions relevant to products. In turn, these present an opportunity for the system to address the operational challenges within the growing cross-border trade and distribution of products in the global market (Organisation for Economic Cooperation and Development, 2009). Data comparisons to provide a comprehensive view of injury patterns in Europe have identified existing systemic issues (Ward & Healy, 2008). One major issue that contributes to the lack of comparability of data is the inconsistency in data collection and classification across data sources (Australian Consumers' Association & Choice Campaigns, 2008).

3.4 AUSTRALIAN INJURY SURVEILLANCE

The collections of injury data in Australia are mainly funded by the health departments in each state and territory, which are separate from the product safety system. The provision of injury data collections in Australia mainly relies on the routine data collection in the hospitals and the existing mortality data collection. However, the provision of injury surveillance systems is confined to only a few states in limited hospitals.

There are many types of injury data collection in Australia. Some are more specialised for specific injury topics, such as spinal injuries, burn injuries and poisoning injuries, and others collect all injuries (QLD Trauma Data Scoping Project Team, 2008). Injury data in Australia are also collected at different levels of care comprising population level or sample data as illustrated in Figure 3-2. There is currently no collection of data on injuries that require no medical treatment or injuries that are treated at the primary care level such as in general practice clinics (McKenzie, et al., 2011). Population data are available on emergency department presentations and hospital admissions (McKenzie, et al., 2011). Injury surveillance data are often sourced and sampled from these population data. The methods of data collection and coding used also vary depending on the purpose and source of the data.



Adopted from McKenzie, et al. 2011

Figure 3-2 Injury pyramid data sources for product safety surveillance

As injury data in Australia are collected separately, there are many structural and characteristics differences in the data that can hinder the attempt to gather national injury data for product safety purposes. The Australian Ministerial Council on Consumer Affairs identified several issues in utilising injury data for product safety purposes including:

- *Difficulties in using existing data to identify specific products or product categories due to the lack of an agreed definition of consumer products;*
- *Difficulties in using current data to identify in a consistent, cost-effective and timely manner, the relative importance of consumer behaviour in product-related injuries and deaths;*
- *Limits on the extent to which data from different administration can be cross-referenced and combined, due to the varying methods of collecting and coding information; and*
- *Lengthy lags in data collection and analysis.*

(Productivity Commission, 2006)

Using one source of injury data may provide useful information to support product safety initiatives however; the information may not represent the full picture of the product safety issue. Using multiple sources of injury data provides the range of information required to describe an injury issue which may not be able to be provided by using a single data source (Driscoll, et al., 2004b). Using multiple data sources also minimises the issue of underestimation of the total number of related injuries (Driscoll, et al., 2004b).

3.4.1 Injury surveillance Units

There are three injury surveillance units in Australia that specialise in routine injury data collection: at the national level, the National Injury Surveillance Unit (NISU) and at the state level, the Victorian Injury Surveillance Unit (VISU) and Queensland Injury Surveillance Unit (QISU). The Australian Institute of Health and Welfare (AIHW) and the Commonwealth Department of Health and Ageing have historically jointly funded the NISU, while the Flinders University's Research Centre for Injury Studies conducts the administration of the unit. The VISU was initially funded by the Victorian Department of Human Services and passed on to the Victorian Department of Health in 2009, while the Monash University's Injury Research Institute conducts the administration. Similarly, in Queensland, the Queensland Health Department funds the QISU, while the Mater health service conducts the administration of the unit.

National Injury Surveillance Unit

The NISU was established in 1991 following the National Injury Prevention Project (1987 – 1989) to continue the work of this project in Australia. The NISU plays an important role in supporting the AIHW's injury prevention operations. NISU's roles include analysis and reporting of existing morbidity data from AIHW and mortality data from the Australian Bureau of Statistics (ABS) (Flinders University Research Centre for Injury Studies, n.d). The NISU also provides expertise to assess needs and opportunities for new injury information sources and mechanisms for data improvement. Furthermore, the unit also plays an important role in providing advice and services on injury prevention and related matters (Flinders University Research Centre for Injury Studies, n.d).

Victorian Injury Surveillance Unit

Similar to the NISU, the VISU, which was formerly known as Victoria's Injury Surveillance System (VISS), was also started through the National Injury Prevention Project (Victorian Injury Surveillance System, 1988). The injury surveillance unit was established before the NISU in 1988. The VISU collects and stores population data from three sources to include three levels of data capture, including death data from the ABS's death unit record files, hospital admissions from the Victorian Admitted Episodes Dataset and emergency department presentations from the Victorian Emergency Minimum dataset (Monash Injury Research Institute, 2014).

Queensland Injury Surveillance Unit

The Queensland Injury Surveillance Unit (QISU) was established in 1988 as the Queensland Injury Surveillance Prevention Program (QISPP). Routine data collection was started in 1989 using paper-based forms in seven Brisbane hospitals. Periodically, data were collected from rural hospitals but not continuously. In 1998, along with the renaming of QISPP to QISU, a major expansion and upgrade was conducted through the establishment of electronic data collection processes and inclusion of new collection sites. Since then, the QISU has been collecting data from a convenience sample of 33 hospital emergency departments throughout Queensland which includes hospitals from metropolitan (Brisbane), regional (Mackay and Moranbah Health Districts), tropical northern coasts (Atherton, Mareeba, Tully and Innisfail) and other remote areas (Mt Isa) (Queensland Injury Surveillance Unit, 2009). Data are made available through a data request service, and periodic information bulletins.

The QISU collects level 1 and level 2 ED-based injury surveillance data based on the National Data Standards for Injury Surveillance (NDS-IS). The level 1 data is basic routine public health data collected for surveillance, whereas level 2 covers more injury details to assist in identification of hazards. A detailed discussion of the NDS-IS data standard will be outlined in the next section. In order to collect detailed data to serve the level 2 NDS-IS data standards, a range of injury data are collected at the point of triage in the emergency departments using an automated injury screen called *InjuryEzy*. Text descriptions of injury as well as coded information regarding the nature of injury, bodily location of injury, injury severity and the intent of injury are included in the injury screen. A full list of data fields in the QISU database are listed in Appendix 2. Product-related injury cases are specified in the data field of 'major injury factors' (MIF), and often product types and the involvement of products in the injury event are also documented in the injury description narratives.

The QISU database is one of Queensland's most detailed data sources to inform product safety surveillance initiatives because the QISU collects additional data items specified in the level 2 NDS-IS which is not collected in any other surveillance system in Australia. Injury data and the details of injury cases in this database can be utilised for both risk assessment and management processes. However, the available data collection is based on a convenience sample of hospitals, and is subject to ascertainment errors and data quality issues in recording and coding. Therefore, it cannot be used for trend analyses over time or place and interpretation of the data needs to be considered in the context of the data quality and completeness limitations.

3.4.2 Admitted Patient Data Collection

The admitted patient data collection details information on all patient separations from hospital admissions. At the national level, the National Admitted Patient Care Dataset collects population data on hospital admissions from all public and private hospitals (Australian Institute of Health and Welfare, n.d.) (Australian Government Department of Health, 2014). The data collection is limited to de-identified information such as patient demographics, hospital episode and clinical information in coded format (Australian Government Department of Health, 2014).

In Queensland, data collection on hospital admissions is called the Queensland Hospital Admitted Patient Data Collection (QHAPDC). Data relating to each hospital's separations (discharges, transfers and deaths) are reported to its respective Health Service District monthly to serve multiple information needs. QHAPDC data informs management, administration, research, funding and monitoring at the hospital level as well as district, state and national levels (Queensland Health Data Services Unit (DSU), 2005). These data can also be used for injury surveillance purposes. QHAPDC has been in operation since 1985. Data are made available upon request, provided appropriate ethical clearances have been obtained.

QHAPDC data are stored in a coded format, with diagnoses, procedures and external causes coded according to International Statistical Classification of Diseases and Related Health Problems, 10th revision - Australian Modification (ICD-10-AM). To identify injury cases with product involvement, the main data fields of interest are the 'principal diagnosis' and 'additional diagnoses' data fields which contain codes to describe the external cause of an injury and the nature of the injury.

The QHAPDC data collection is limited to those cases serious enough to warrant hospitalisation. However, the use of a standardised classification system that is comparable at an intra-state, national and, to some degree, international level over time offers considerable strengths in terms of trend analyses and jurisdictional comparisons.

3.4.3 Other Injury Data Sources

There are many other data sources that collect injury data in Queensland. In Queensland healthcare settings, injury data can also be obtained from the Emergency Department Information System (EDIS) data. Several government agencies are also collecting fatal injury data at state and national levels. In most states and territories, a child death review team collects fatal injury data for children. At the national level, injury fatalities are collected by the National Coronial Information System (NCIS) and the Australian Bureau of Statistics (ABS). There are also injury data collections for specific types of injury such burn data collected by Burn Units and poisoning data collected by the Poisons Information Centre. However, these data sources are not included in this study as they are outside of the scope of this research.

Nationally, survey-based data collections are also available as avenues for injury data collection. The National Health Survey (NHS), for instance, is conducted every three years by the ABS to obtain national benchmark information on a range of issues. Data collected through the NHS enable trends in health issues to be monitored over time and provide information on health indicators for Australian national health priorities. Injury related data items are collected as part of this survey, though the detail and granularity of information is limited, as there are only two questions concerning injury; 1) whether the health condition reported by the respondent was caused by injury; 2) the location of the injury's occurrence (Australian Bureau of Statistics, 2013). Neither of these questions pertains to, or details, occurrences of product-related injury.

Another avenue for data collection on children-related issues is the Longitudinal Study of Australia's Children (LSAC) which is conducted every two years by the Australian Institute for Family Studies (AIFS). The study follows the development of 10,000 children and their families from all Australian states and territories to monitor children's physical health and social, cognitive and emotional development and their experiences in each of these environments. The survey collects information on parents' perspectives on these environments and on child supervision which can be useful to inform product safety initiatives in addressing product-related injuries in children. The survey does not specifically collect data on product-related injury; however recommendations to the AIFS can be made to include additional collection of injury information.

3.5 CHAPTER SUMMARY

Chapter three discussed the theoretical framework and the characteristics of injury prevention and surveillance systems in Australia in order to explore the potential of injury data to support product safety regulation in Australia. The concept of injury prevention developed from the early work of Haddon, describing the transfer of energy in the event of injury. Several examples of international injury surveillance systems were discussed including the NEISS system in the US, the CHIRPP system in Canada and the IDB in Europe. These injury surveillance units are integrated or partially integrated with their respective product safety systems. The injury data collections in Australian settings were also explored. In the Australian context, the systems are mainly funded by the health departments in each state and territory, which are separate from the product safety system.

The next chapter will explore product safety surveillance systems internationally and the concept of prioritisation. Product safety prioritisation criteria can be used as tools to interrogate injury data to enable prioritisation of responses. As the product safety field advances, the need for evidence-based decision making grows and developing more scientific methods for prioritisation is an emerging area in the product injury research field.

Chapter 4:Literature Review – Using ED-based Injury Surveillance Data for Product Safety Prioritisation

Chapter 4: Literature Review – Using ED-based Injury Surveillance Data for Product Safety Prioritisation

The product safety system and injury prevention frameworks hold similar characteristics and objectives. In the product safety system, risk assessment processes are used to identify and estimate risk to develop regulations to reduce risk (Chapter 2), and in the injury prevention area, injury surveillance is used to identify causes of injury to design prevention policy and programs (Chapter 3). While Australian product safety regulators rely on an ad hoc reactive approach to surveillance of product-related injuries, several countries around the world have more established injury surveillance systems run by consumer safety organisations to maintain active surveillance.

This chapter will explore three prioritisation criteria for product safety issues (i.e. frequency, severity and causality) and the techniques and approaches used to interrogate injury data based on these criteria will be discussed. Lastly, Section 4.3 will outline the application of these product safety prioritisation criteria to the current study.

4.1 PRODUCT SAFETY PRIORITISATION

As previously discussed, the similarities between injury prevention and product safety frameworks suggest that there are opportunities to use existing injury data collections to support product safety initiatives. Injury prevention and product safety initiatives both seek to maximise the effectiveness and impact of resource allocation. In injury prevention, prioritisation of resource allocation is targeted at issues with high frequency, severity and preventability (Driscoll, et al., 2004b). Similarly, based on the current review of the Australian product safety system, a stronger focus has been placed upon hazard identification, risk assessment and management to prioritise and allocate resources for product-related hazards leading to injury and death (Productivity Commission, 2006).

A prioritisation framework using a set of preventability criteria has been used in the European injury data in a preventative product safety analysis study project conducted by the Institute Sicher Leben. The product safety prioritisation criteria used in the project were frequency, severity and product causality (Bauer & Sector, 2000). Based on the findings of the study, these three prioritisation criteria were recommended to be used in an indicator-based reporting tool for product safety related research (Bauer & Sector, 2000).

The application of similar prioritisation criteria using injury data collected in Australia and for this current study in Queensland is comparatively different to the European data due to the structure of data and the use of different classification systems. Several possible techniques to interrogate the frequency, severity and causality of product related injuries using injury data in the Queensland setting are identified through the literature review below.

4.2 FREQUENCY

Frequency is a common measure used to report injury burden. Frequency is the count or number of injury cases identified in the data (Driscoll, et al., 2004a). Frequency of injury is often used to determine the ranking and magnitude of the injury burden and to convey the health burden (Driscoll, et al., 2004a). Frequency of injury cases can be presented as percentages and proportions to compare demographic characteristics such as age and sex (Bauer & Sector, 2000). In relation to product safety issues, the frequency of injury cases associated with the product of interest can assist to quantify the magnitude of the product safety issue.

The process of identifying the frequency of injuries and specific types of injuries in the injury data can be challenging due to several limitations in the implementation of injury surveillance systems and the structure of the injury data itself. It is not feasible to measure the actual number of all injuries including the product-related injuries. Minor injuries that are treated in primary healthcare or those injuries that do not require medical attention are not captured in any data collection (McKenzie, et al., 2011). The actual number of injuries based on injury data is often expressed as an estimate as data are collected through sampling methods which might be associated with underestimation or overestimation due to sampling bias (Driscoll, et al., 2004b). These issues may not be resolved completely due to infrastructure and resource constraints. However, injury data collections have always been considered a necessary means to increase data coverage.

Another issue that may affect the identification of the frequency of product-related injuries is the vague definition of a consumer product and the inclusion/exclusion criteria for what is categorised as a consumer product (Bauer & Steiner, 2009). There are also other issues in the identification of product-related injuries that are related to the availability of product codes in classification systems and the completeness of coded and text narrative data. Regardless of all of these limitations, injury data are recognised as the most useful product-related injury source for the product safety system (Bauer & Sector, 2000) .

The process of identifying product-related injuries can be conducted using proactive and reactive approaches. A ***proactive approach*** is defined as an enumeration process of all product-related injuries recorded in the data and identifying the type of product and/or injury with the highest frequency for prioritisation. A ***reactive approach*** is defined as a process of identifying injuries that are related to a specific known type of product (those which product safety regulators are aware of and are seeking data for). This research study focussed mainly on the outcomes of the analyses conducted using a proactive approach. However, several analyses using a reactive approach to identify product-related injuries were also conducted. The results of these analyses are available in Appendix 6.

There are three techniques that are often used to interrogate injury data to quantify the number of product-related injuries depending on the availability and quality of the coded and text narrative data.

4.2.1 Product codes analysis

The majority of health classification systems include a range of codes that are used to indicate the involvement of a product or object in the injury event as an external cause. Product or object codes are often listed in a specific module, although some are integrated into other external cause codes. In this chapter, product coding from three different health classification systems is discussed.

The classification system used in health databases has a significant impact on the collection, storage and analysis of injury data. The main value of adopting a classification system in a surveillance system is to simplify qualitative written medical text from records into standardised codes through a process of applying classification rules via a convention called ‘clinical coding’ (Walker & McEvoy, 2004). There are several types of classification systems that have been used in health databases. Classification systems can vary in level of detail, depending on the intended purpose of developing the system. Classification systems can serve multiple purposes such as production of health statistics, hospital reporting, administration and funding, health management and planning and research. Some classification systems have been developed to aid specific purposes. For instance, to support injury prevention and surveillance, National Data Standards for Injury Surveillance (NDS-IS) and the International Classification of External Causes of Injuries (ICECI) have been developed to improve injury data collection.

International Statistical Classification of Diseases and Related Health Problems (ICD)

The International Statistical Classification of Diseases and Related Health Problems (ICD) is the most commonly used classification system in health databases around the world. The development of the ICD began at the first attempt to classify disease systematically by François Bossier de Lacroix in the early 19th century (World Health Organization (WHO), n.d.). Since then the classification has been revised and redeveloped to serve multiple purposes. The direct ancestor of the ICD, the International List of Causes of Death developed by Jacques Bertillon in 1893 was developed to classify mortality data (McKenzie, Fingerhut, Walker, Harrison, & Harrison, 2012). Later revisions of this classification were also used to classify hospitalisations and non-fatal cases. The use of classifications for understanding and preventing injury events has been made possible since the inclusion of an external causes section in the sixth revision of the ICD (McKenzie, et al., 2012). The structure of the external causes section in the ICD has been reviewed and revised to meet current injury trends over time. A detailed explanation of the evolution of the external cause classification in ICD was summarised by McKenzie at al. (2012) (McKenzie, et al., 2012) (Table 4-1).

Table 4-1 - The evolution of External Cause Classification in ICD

The evolution of External Cause Classification in ICD Adopted from McKenzie at al 2012 (McKenzie, et al., 2012)	
Mid-19th century	Farr system William Farr developed the classification of causes of death used for the first-ever national death register, in England and Wales. He established the importance of physical and chemical forces resulting in ‘‘violent deaths or diseases’’ by considering these as 1 of the 5 major disease categories. Three causal factors important for injury prevention were captured under the Farr system: ‘‘human agency,’’ ‘‘mode in which death is produced,’’ and ‘‘circumstances in which fatal accidents occur.’’
1893	The International List of Causes of Death This is the direct ancestor of ICD developed by Jacques Bertillon. The list was first revised in 1900 and then about once per decade. Although not termed ICD until later, this list was the basis for numbering revisions of the ICD.
1948	Sixth Revision of ICD This revision was the first published under the auspices of the World Health Organisation. It included the most substantial changes to the classification of injuries and external causes. Nature of the injury and details as to how it occurred (external causes) were divided into distinct sections and described as alternative classifications. Changes since the sixth revision consist largely of adding specificity and detail to code blocks within the external causes chapter, with limited structural changes being made in the last 60 years
1965	Eighth Revision of ICD A section was added to the 8th revision for ‘‘Injury undetermined whether accidentally or purposely inflicted”.
1975	Ninth Revision of ICD-9 The injury chapter was included in the main sequence of disease chapters, and the external causes chapter was described as supplementary.
1992	Tenth revision of ICD Change of name from “Supplementary classification of external cause of injury and poisoning” to “External causes of morbidity and mortality”. Structural changes which included a change from a numeric system to an alphanumeric code structure. Code in the External causes chapter changed from E800 to E999 code range to codes prefixed with a V, W, X, or Y.

The most current version of the ICD is the International Statistical Classification of Disease and Related Health Problems – 10th revision (ICD-10). This version has been modified to meet the specific needs of clinical coding of morbidity records in Australia and is called the International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian Modification (ICD-10-AM).

There are two chapters of the ICD-10-AM (and its parent, ICD-10) that are designated to address injury and poisoning coding (National Centre for Classification in Health, 2008b). The ICD-10-AM's Chapter 19 consists of the injury and poisoning diagnosis codes which are structured based on injured body regions and nature of injury (National Centre for Classification in Health, 2008b). The alphanumeric codes in Chapter 19 range from S00 to T98 in which the second digit represents the body region while the third digit represents the nature of injury. Fourth and fifth digits are also used to specifically identify the part of the body region and specific nature of injury (National Centre for Classification in Health, 2008b).

The ICD-10-AM's Chapter 20 consists of the external causes of morbidity codes (National Centre for Classification in Health, 2008b). The chapter is structured based on the intent of the injury including accidental, self-harm, assault and undetermined intent. There are also other categories in this chapter which include complications of medical and surgical care, sequelae of morbidity as well as legal interventions and operations of war (National Centre for Classification in Health, 2008b). The codes for accidents range from V01 – X59 and are further categorised based on the mechanisms of injury and object/product involved in the injury event (National Centre for Classification in Health, 2008b).

A range of codes in Chapter 20 of the ICD-10-AM's guidelines captures product involvement in the injury event. According to the Australian Coding Standards, external cause codes in Chapter 20 of the aforementioned document are to be used as additional codes with an injury codes from Chapter 19 or with codes from other chapters where the external cause code adds specificity to the diagnosis (National Centre for Classification in Health, 2008a). The coding of the full set of principal and additional codes however, is only available for patients admitted to hospital (Data Collection Unit Queensland Health, 2009). Injury data collected in emergency based settings often only include the principal injury code/s. Therefore, the identification of product-related injuries using ICD external cause codes can only be performed on hospital admission data.

The specificity of product coding using ICD-10-AM (and ICD-10) has been discussed as an issue in the literature. The scope of the current classification systems for product safety purposes is not well equipped to capture the constant introduction of new products into the market and therefore, is similarly ill-equipped to identify emerging hazards. Previous research conducted to examine the external cause codes in Australian hospital admission data revealed that product information is more detailed in text fields than in the ICD code descriptions (McKenzie, Fingerhut, & Harrison, 2010). It has been argued that the level of product specificity in ICD-10-AM has been influenced by the inconsistency of product definitions (Access Economics Pty Limited, 2007). In order to supplement the product classification in ICD-10-AM, the use of the International Classification of External Causes of Injury (ICECI), which provides more detailed injury information, has been widely supported by studies and product regulatory organisations (Access Economics Pty Limited, 2007; Productivity Commission, 2006). A list of product-related ICD external cause codes was developed as part of the methodology for this research and is available in Appendix 4.

International Classification of External Causes of Injuries (ICECI)

The International Classification of External Causes of Injuries (ICECI) is a part of the WHO Family of International Classifications. Initially developed in 1998, it addresses a need for injury surveillance data classifications. The ICECI was developed by the ICECI Coordination and Maintenance Group, a joint collaboration of the Netherlands' Consumer Safety Institute and the Australian National Injury Surveillance Unit (ICECI Coordination and Maintenance Group, 2004). This classification was intended to aid the development of effective injury surveillance (Holder, et al., 2001). ICECI was designed to provide more detail than the ICD and to inform better understanding of an injury external cause. The latest version of the ICECI, released in 2004, comprises several modules including core modules for basic levels of injury surveillance. Additional modules are also available to address specific areas of injury interest, including violence, transport, place, sport and occupational injuries (ICECI Coordination and Maintenance Group, 2004).

The ICECI is intended to complement the ICD codes in chapter 20, and enable a simple comparison process for data coded with either system (McKenzie & Fingerhut, 2010). The modules in this classification are structured by hierarchical data elements that can be recorded independently (ICECI Coordination and Maintenance Group, 2004). For instance, mechanism and intent of injury are coded in two individual data elements, whereas in ICD chapter 20, mechanism and intent are coded collectively in a single code (McKenzie & Fingerhut, 2010). For product safety purposes, the ICECI captures various injury domains and specifically records product types as the object/substance producing injury in its core module (Appendix 5).

A study by Scott et al. (2006) that examined the practicality and reliability of the ICECI, showed favourable results and advocated for the continued use of the ICECI as a tool in research(Scott et al., 2006). The hierarchical structure of its data elements from basic to high levels of detail provides flexibility for researchers to address their research questions (Scott, et al., 2006).

The product and object codes are included in the core modules of the ICECI as the *C3 Object/substance* module to provide an overview of what types of things were involved in the injury mechanism (ICECI Coordination and Maintenance Group, 2004). The structure of the C3 Object/substance module is hierarchical, similar to the other core modules, to allow specific and broader categories for product and substance (ICECI Coordination and Maintenance Group, 2004). This structure can minimise the use of unspecified or 'dump' codes if a product/object code is not available during the coding process. The development of the C3 module also considered the sequence of events in the occurrence of the injury in which more than one product/object may be involved. Three types of objects/substances were considered in the ICECI product/object coding, the *underlying object* which was involved at the start of the injury, the *direct object* which was involved in the production of the physical harm and any other object that may have been involved as an *intermediate object* (ICECI Coordination and Maintenance Group, 2004).

The ICECI's Object/Substance coding scheme appears to be the most constructive product coding available to support the product safety system. As discussed in the previous section, a 2006 study found favourable results in relation to the practicability and reliability of the ICECI coding system (Scott, et al., 2006). However, the ICECI has not been utilised broadly in Australia even though the development of ICECI was partly conducted by the Australian National Injury Surveillance Unit. The existing injury surveillance data collections in Queensland and Victoria are still currently using the superseded coding system.

National Data Standards for Injury Surveillance (NDS-IS)

The National Data Standards for Injury Surveillance (NDS-IS) form an Australian classification system for injury surveillance which was initially established in 1995 based on the recommendations of the NDS-IS Advisory Group. The Advisory Group represented members from the Monash University Accident Research Centre, the Tasmanian Injury Surveillance and Prevention Project, the Queensland Injury Surveillance and Prevention Program, Farmsafe Australia, NISU and other institutions. The main purpose of these data standards is to support the collection of data for injury prevention purposes (National Injury Surveillance Unit, 1998).

The latest revision of NDS-IS is structured into two levels of data items and coding specifications. Level 1 data consists of five core injury data items including a narrative description of each injury event, external causes, place of injury, activity when injured, nature and bodily location of main injury. Level 2 data provides more detailed classifications and additional data items (i.e. principal diagnosis, major injury factor, mechanism of injury, date and time of injury). Level 1 is intended to collect simple data items, whereas Level 2 is designed for data collection in emergency departments (National Injury Surveillance Unit, 1998).

In the NDS-IS, a range of product or object codes are listed in a specific data item called the Major Injury Factors (MIF) under the level 2 data collection. The MIF codes list (See Appendix 3) which includes types of objects and substances, enables categorisation of injury cases according to the factors involved in the occurrence of injury (National Injury Surveillance Unit, 1998). The MIF coding also requires distinction between the breakdown factors which imply ‘what went wrong’ and the mechanism factors which imply how the injury was produced (National Injury Surveillance Unit, 1998).

There are several disadvantages that can be identified in the use of MIF codes to identify product-related injuries. Firstly, the list of product codes has not been recently updated, hence cannot be used to specifically identify new products. Those injury cases that do not have specific codes are normally assigned to the ‘other or unspecified’ codes which may indicate that a lot of emerging issues are being ‘hidden’ in these codes. Another limitation related to the collection of MIF data is that it is only conducted in injury surveillance units that collect level 2 data (National Injury Surveillance Unit, 1998).

4.2.2 Text Narrative

In addition to coded data, injury data are often stored in the form of text narratives. Coded data can be disadvantaged by dependencies on the availability of codes in the classification system to describe injury information. Although processes exist for updating most classification systems, trends in new consumer products may not be addressed promptly, hence the need to rely on text arises to identify emerging hazards.

In Queensland health data, text narratives that can potentially provide relevant injury data are collected in emergency departments (EDIS) and in the ED-based injury surveillance unit (QISU). These text fields include text documented by the triage nurses at the first stage of patient presentation at emergency departments. Other types of text narrative data include the presenting problem, which is recorded in text form. The text narrative data are not reported as part of the admitted patient data collection (QHAPDC). However, text fields are available in patient medical records for review if further investigation is required.

Text narratives play a pivotal role in the utilisation of health data. A study by Jones and Lyons (2003) to examine the role of text narratives in improving the understanding of injury causes concluded that text narratives aid in increasing the quality of injury data (Jones & Lyons, 2003). These authors found that text narratives provided more informative injury data and reduced the proportion of unknown cases from 67.5% to 49.5% when text narrative data was included in their analysis (Jones & Lyons, 2003). The study also reported that text narratives increase the detection rate of relevant injury cases by adding more cases to the initial detection by codes (Jones & Lyons, 2003). Additionally, a systematic review on the use of text narrative data by McKenzie et al. (2010) reported that text data have been used as tools to validate and check the accuracy of coded data (McKenzie, Scott, Campbell, & McClure, 2010). Text narratives can be used to provide useful information through an analytical process called text mining.

Text mining

Text mining is defined as a process of finding patterns of recurring and predictive word combinations, and transforming unstructured data into structured data (Weiss, Indurkhya, Zhang, & Damerau, 2005). The process of extracting words in the data is called keywords extraction, whereas the transformation of data into structured data is called classification and clustering (Berry & Kogan, 2010; Rose, Engel, Cramer, & Cowley, 2010). Keywords have been used extensively in search queries (algorithms) to retrieve information mainly using predefined terms (Rose, et al., 2010). However, this method cannot detect unknown words or phrases (Zhang, Xu, Tang, & Li, 2006).

Text mining techniques can be used to retrieve product-related injuries in injury data. There are several text mining-like methods that have been used to interrogate text narratives in the injury data. A systematic review has been conducted by McKenzie et al. (2010) to examine the methods that have been used in injury research to interrogate injury text narrative data. The review identified several common techniques including text narrative review and coding approaches, text search methods, and statistical tools (McKenzie, Scott, et al., 2010). More complex techniques have also been developed using semi-automated computerised approaches and Bayesian/clustering statistical methods to interrogate text data (McKenzie, Scott, et al., 2010). The results of the review of each method are discussed in the following table:

Table 4-2 Text Mining Techniques & Methodology

Text Mining Technique	**Methodology**	**Common Strengths (+) & Weaknesses (-)**
Text narrative review and recoding	Using relevant standardised classification system to capture additional information from text narratives	+ Allows recoding of data using alternative classification system + Allows identification of errors in coding - However, this technique can be time-consuming and labour intensive for large dataset
Text Search	Using individual words (keyword serach) or indexes of words (index search) in a search algorithm to retrieve cases and identify additional information	+ Enables identification of cases which are unable to be identified through codes + Can be applied to larger dataset - The use of search algorithm is subjected to specificity and sensitivity issues (depending on the study)
Bayesian/clustering	Using Bayesian/clustering principles based on high probability of association to categorise cases.	+ Can be used to process cases for simple categorisation to reduce cases requiring text narrative review - Irrelevant words can inhibit the accuracy of categorisation of the system - This method is also subject to the specificity and sensitivity issues therefore still requiring iterative text narrative review to refine the automatic process

Adopted from (McKenzie, Scott, et al., 2010).

Text mining techniques that use automatic search algorithms are often subjected to specificity and sensitivity issues. Specificity is the ability of the search algorithm to eliminate unrelated cases (true negatives) whereas sensitivity is the ability of the search algorithm to identify related cases (true positives) (Williamson, Feyer, Stout, Driscoll, & Usher, 2001). High specificity issues occur when the search algorithm misses related cases (false negatives) due to strict criteria. On the other hand, high sensitivity issues occurs when the search algorithm includes a large number of unrelated cases (false positives) due to broad criteria (McKenzie et al., 2010). Depending on the type of study, it is important to maintain the level of the sensitivity and specificity, in order to keep the appropriate level of accuracy of the search algorithm. There is often a trade-off (Williamson, et al., 2001).

Based on the result of the systematic review conducted by McKenzie et al. (2010), several recommendations were made to improve text mining approaches. In general, quality assurance methods such as using an iterative process of extraction, text narrative review, refinement and re-extraction of data as well as the use of gold standards to assess results from automated processes are recommended to ensure accuracy of text mining results (McKenzie, Campbell, et al., 2010). In a text narrative review process, it is important to ensure that inclusion and exclusion criteria and structured forms are used (McKenzie, Campbell, et al., 2010). In the text search method, an iterative development and review of the search algorithm involving experts in the injury field is important to ensure the appropriate level of accuracy of the search algorithm (McKenzie, Campbell, et al., 2010). Furthermore, in the use of Bayesian/clustering method, it is important to refine the system iteratively and to validate results using gold standard manual coding (McKenzie, Campbell, et al., 2010).

4.3 SEVERITY

In addition to the frequency of injury, injury severity is a key factor to determine effective prioritisation of product safety interventions. Severity can be described as the proportion of the injured patients with short, medium and long term disabilities or injuries resulting in fatality (Driscoll, et al., 2004a). Severity of injury is also defined as damage to the body due to injury validated against mortality outcomes (Cryer, 2006). Hence, severity of injury in this study is defined as the intensity of the damage to the body as a result of the injury event which can be assessed based on disability and fatal outcome. The Productivity Commission advocates for the product safety system to focus on the most serious product-related injury issues, therefore prioritising products associated with high injury severity (Productivity Commission, 2006).

Ideally, severity should be measured directly, based on individual patient conditions. However, this requires highly skilled staff, as well as additional time and cost pressures (Cryer, 2006). Therefore, several techniques have been developed to measure the severity of injury, which is often presented using a scoring system, with different levels of accuracy and complexity. Severity can be measured by a number of techniques, including; considering the urgency, the outcome of hospital treatment, the length of hospital stay, medical cost and the fatality or disability outcomes.

While health data does not regularly capture disability aspects as these often occur or are diagnosed post-treatment, disability outcomes can sometimes be predicted. Several studies have been conducted to explore this method of prediction. Gabbe et al. (2011) mapped ICD 10 codes into the 10 Global Burden of Disease (GBD) health states, using the Glasgow Outcome Scale – Extended. The data were analysed using worst case, additive and multiplicative techniques. The study found that the majority of patients survived with persisting disability at 12 months post injury, highlighting the importance of improved estimations of the implications associated with non-fatal injuries (Gabbe, Harrison, Lyons, & Jolley, 2011). The additive and ‘‘worst injury’’ models demonstrated acceptable calibration. However, further evaluation using the additional measures of health status and functioning ability are required to optimise the measurement (Gabbe, et al., 2011).

A secondary study by Gabbe et al. (2013) used ICD comorbidity codes to predict disability outcomes through a range of methods such as the Charlson comorbid index, the functional comorbidity index and the ICD Chapters method. The study found that comorbidity conditions can affect the long term disability experienced by injury survivors (Gabbe, Harrison, Lyons, Edwards, & Cameron, 2013). However, the study found that none of the approaches demonstrated acceptable model calibration and adjustment for comorbidity had not been well explored (Gabbe, et al., 2013).

Other works around the world have also been done to measure severity in terms of predicted treatment outcome and medical cost (Lyons et al., 2007; Mulder, Meerding, & van Beeck, 2002; Polinder et al., 2007). However, while medical cost and predicted treatment outcome and disability are useful in measuring injury severity for injury prevention in general, these were excluded from the study as it involves complex codes mapping and analysis which may not be practical for the product safety regulator. Furthermore, medical cost is considered outside the scope of product safety regulators as prioritisations in product safety systems are made based on risk assessment and health systems costs are not borne by the product safety system.

4.3.1 Healthcare-based severity ratings

There are many severity-scoring systems that are used in healthcare settings in Australia. Below are some of them:

Triage Scoring System

Triage-scoring system is an emergency department-based prioritisation tool that is often used to measure injury urgency but has been used as a proxy measure of severity. The main purpose of a triage-scoring system is as a tool to prioritise the distribution of medical resources to patients at the emergency department (Iserson & Moskop, 2007). The concept, triage, originated from a French word *trier* which means to sort (Iserson & Moskop, 2007).

The development of triage systems in Australia was first initiated in the Ipswich Hospital's ED in Queensland (FitzGerald, Jelinek, Scott, & Gerdtz, 2010). The triage categories (see Table 4-3) were determined based on the urgency tests for the ED patients' conditions (FitzGerald, et al., 2010). The scale system was then adopted as the National Triage Scale and accordingly as the Australasian Triage Scale (ATS) (FitzGerald, et al., 2010). The system was also used as a model for the Manchester Triage Scale in the UK and the Canadian Triage and Acuity Scale (FitzGerald, et al., 2010).

Table 4-3 The Australian Triage Scale's Categories

Triage Categories	Level of Acuity	Urgency of ED Treatment (Maximum waiting time)
Category 1	Immediately life-threatening	Immediately
Category 2	Imminently life-threatening	10 minutes
Category 3	Potentially life-threatening or important time-critical treatment or severe pain	30 minutes
Category 4	Potentially life-serious or situational urgency or significant complexity	60 minutes
Category 5	Less urgent	120 minutes

Source: Emergency Triage Education Kit (Department of Health and Ageing, 2009)

Triage scoring has been used as an important measure for various non-medical purposes. The ATS was used as a tool for benchmarking, funding measures, clinical indicators and performance reporting (FitzGerald, et al., 2010; Steering Committee for the Review of Government Service Provision, 2009). For product safety purposes, the ED triage data can also be used as an indicator of the acuity of product-related injuries. However, it is important to consider that the triage scoring scales are designed chiefly to reflect the urgency of ED treatment and may not necessarily reflect on injury severity (FitzGerald, et al., 2010). Therefore, triage data should be used in conjunction with other severity measures.

Discharge Status

In addition to triage data, discharge status or mode of separation can be used as a tool to indicate injury severity. The mode of separation has been used as a tool in a more complex injury severity scoring system, The International Classification of Disease Injury Severity Score (ICISS), to generate a Survival Risk Ratio (SRR) (Henley & Harrison, 2009). Hence, mode of separation can be a basic indicator of injury severity that is easily available in health data.

Discharge status or mode of separation is one of the main data items in Queensland Hospital Admission Data (QHAPDC data) as well as in ED-based injury surveillance data (Data Collection Unit Queensland Health, 2009; National Injury Surveillance Unit, 1998). In the QHAPDC data, mode of separation is used to indicate the place a patient is referred to following an episode of treatment in the hospital (Data Collection Unit Queensland Health, 2009). Similarly, in ED-based injury surveillance data, mode of separation is defined as the status following the medical treatment at the ED (National Injury Surveillance Unit, 1998). The categories used in hospital admission data and ED-based injury surveillance data are provided below:

Table 4-4 Mode of separations in admission & ED-based injury surveillance data

Hospital admission data **Mode of separation codes list**	**ED-based injury surveillance** **Mode of separation codes list**
01 Home/usual residence 16 Hospital Transfer 15 Residential Aged Care Service 05 Died in hospital 06 Care Type change 07 Discharged at own risk 09 Non-return from leave 12 Correctional facility 17 Medi-hotel 04 Other health care accommodation 19 Other 13 Organ Procurement (Used to denote the cessation of an organ procurement registration) 14 Boarder (Used to denote the completion of a boarder registration)	01 Admitted (excluding. ED bed) 02 ED service event completed – Discharged 03 Transfer to another hospital 04 Did not wait 05 Left after treatment commenced 06 Died in ED 07 Dead on arrival (no treatment provided in ED)

Source: QHAPDC Manual (Data Collection Unit Queensland Health, 2009) and QISU data

The International Classification of Disease Injury Severity Score

The International Classification of Disease Injury Severity Score (ICISS) is a scoring system based on the assignment of principal ICD diagnosis codes at the end of each patient hospitalisation. Stephenson et al. (2003) previously used the ICISS method on Australian and New Zealand hospital admission data (Stephenson, Henley, Harrison, & Langley, 2003). Their study involved the assignment of Survival Risk Ratios (SRR) based on 523,633 Australian and 124,767 New Zealand hospital separations, which included 7,230 and 1,565 deaths respectively.

An SRR refers to the probability of a patient surviving an injury. Each ICD diagnosis code assigned to a patient is related to an SRR (Stephenson, et al., 2003). The SRR assigned to each individual injury diagnosis code involves the calculation of a ratio based on the number of non-fatalities to the total number of patients within the assigned code (Stephenson, et al., 2003). Thus, SRRs represent the likelihood of patient survival following injury, with scores closest to 1 indicative of higher survival rates (an SRR of 1 = 100% survival rate) (Stephenson, et al., 2003). The outcome of the study provides a list of ICD-based SRRs that can be applied when analysing similar data.

The ICISS score can be a single SRR if the patient only sustains a single injury or in case of multiple injuries the ICISS score can be determined using a range of methods. The original method of calculating ICISS score is the multiplicative model in which all SRRs in patient’s record were multiplied to obtain the ICISS score (Henley & Harrison, 2009). The worst-injury ICISS method used the smallest SRR among all the injury diagnoses SRRs (Henley & Harrison, 2009). The hybrid models incorporate both multiplicative and worst-injury models based on the injury codes (Henley & Harrison, 2009).

This method is less complicated than the AIS and ISS approaches, however, frequent updates are required to maintain the currency of SRRs and to ensure comparability with the current ICD version.

The Abbreviated Injury Scale

The Abbreviated Injury Scale (AIS) is an anatomical injury scoring system which was initially developed by the Association for the Advancement of Automotive Medicine (AAAM) in 1969 to aid vehicle crash investigations (Committee of Medical Aspects of Automotive Safety, 1971). The scoring system was further revised in 1990 to accommodate other medical and research activities and updated in 1998, 2004 and 2008 with additional codes and rules (Association for the Advancement of Automotive Medicine (AAAM), 2005; McEvoy & Walker, 2004). The scoring system relies on a six point ordinal scale to determine the severity of injury over approximately 1300 injury categories by body region. The AIS coding manual is required to assign a score to an injury case (McEvoy & Walker, 2004). Therefore this system can be time consuming and labour intensive as it requires each unique case to be coded individually (McEvoy & Walker, 2004).

The Injury Severity Score (ISS) uses several AIS codes to act as a scoring system for multiple injuries. ISS was developed by Baker et al. in 1974 to provide a numerical description of overall injury severity in patients sustaining injury in more than one body region (Baker, O'Neill, Haddon, & Long, 1974). This system requires more effort than AIS as it involves additional calculations to add all ISS scores for each injury (McEvoy & Walker, 2004).

The severity of product-related injury from health data coded with ICD can be assessed by using the diagnoses codes that include information about the nature of injury and body region injured. A study by Clark and Ahmad for example, used the diagnoses codes to estimate injury severity by utilising the Barell matrix (Clark & Ahmad, 2006). Each cell in the Barrel matrix, depending on the diagnoses and body region code, is assigned an Abbreviated Injury Scale (AIS) score and an Injury Severity Score (ISS) (Clark & Ahmad, 2006). The study found that survival rates calculated using abbreviated Barell categorisation were similar to the survival rates calculated with ICISS (Clark & Ahmad, 2006).

4.3.2 Risk assessment-based severity ratings

There are many severity-scoring systems that are used in product safety settings. Below are the severity rating systems that are used by Australian Product Safety regulators in the product risk assessment:

Nomograph severity ranking

The Nomograph severity ranking is a severity tool used in the Nomograph risk assessment process. Severity in the Nomograph system is used to indicate the maximum potential injury (Benis, 1990). The severity scales categorise the potential injury into a six point scale of minor, moderate, serious, severe, critical, and death (Benis, 1990). A guideline table outlining several types of injury examples and the severity scales is used to assist risk assessors (Benis, 1990). The table was developed based on the Abbreviated Injury Scale (AIS) which is aligned to the structure of the International Classification of Disease (ICD) (Benis, 1990). However, the determination of maximum potential injury using the guidelines is still subject to a degree of subjectivity. Consideration of the patient’s age is also another factor that needs to be assessed when determining the maximum potential injury using this method.

RAPEX severity rating

The RAPEX severity rating system is used in the European RAPEX risk assessment. The same severity rating system was also adopted in Australia in 2012. The severity of injury is identified using a 4-point scale severity rating. The four levels of severity which were developed to reflect the treatment required and consequences of the injury are outlined below. The level of severity is determined based on: the type of hazard; the intensity of the hazard; the length of time of the exposure to the hazard; the body part injured; the impact on the body part; and the type and behaviour of the injured person (consumer). The description of each level is explained below:

- Severity level 1 – Injury or consequence that after basic treatment (first aid, normally not by a doctor) does not substantially hamper functioning or cause excessive pain; usually the consequences are completely reversible.
- Severity level 2 – Injury or consequence for which a visit to A & E may be necessary, but in general, hospitalisation is not required. Functioning may be affected for a limited period, not more than about 6 months, and recovery is more or less complete.
- Severity level 3 – Injury or consequence that normally requires hospitalisation and will affect functioning for more than 6 months or lead to a permanent loss of function.
- Severity level 4 – Injury or consequence that is or could be fatal, including: brain death; consequences that affect reproduction or offspring; severe loss of limbs and/or function leading to more than approximately 10% of disability.

(European Commission, 2010)

A RAPEX tool guideline table was developed to assist the risk assessor in determining the severity of the injury based on the gathered information (European Commission, 2010). The severity level determined using the table is expected to reflect the treatment required for the type of injury associated with the product hazard outlined above. However, there is no previous study that has tested and confirmed the correspondence of the injury types in the guideline table with the severity level descriptions. Another drawback of this approach is the absence of age considerations in the guidelines to account for the differences in vulnerability in different age groups. Therefore the type of injury examples can misclassify the level of treatment required or the consequences of the injury.

One of injury statistics sources for the RAPEX product risk assessment is the European Injury Database (IDB) (European Commission, 2007, 2010). In 2009, Eurosafe released an overview report of injuries in Europe based on the 2005 to 2007 IDB data in which it was estimated that 5700 fatalities in Europe every year were related to product involvement (Bauer & Steiner, 2009). In the report, it was also highlighted that IDB data can provide valuable information to support risk assessment for product safety purposes (Bauer & Steiner, 2009).

4.4 CAUSALITY

In addition to frequency and severity, product causality is another important factor that should be considered in the process of prioritising product safety initiatives. However, causality is the hardest criteria to quantify using traditional ED-based injury surveillance data sources and has barely been included in analyses utilising injury data collections, despite being arguably the most important factor to product safety regulators. Causality is an epidemiological term that can be defined as 'an event, condition, or characteristic that plays an essential role in producing an occurrence of the condition' (Stevenson, 2004). Therefore from this definition 'product causality' can be defined as a condition where a product plays an essential role in producing an occurrence of injury or damage. The term 'product causality' is used in a preventative product safety analysis project to describe the contribution of the product in an accident (Bauer & Sector, 2000).

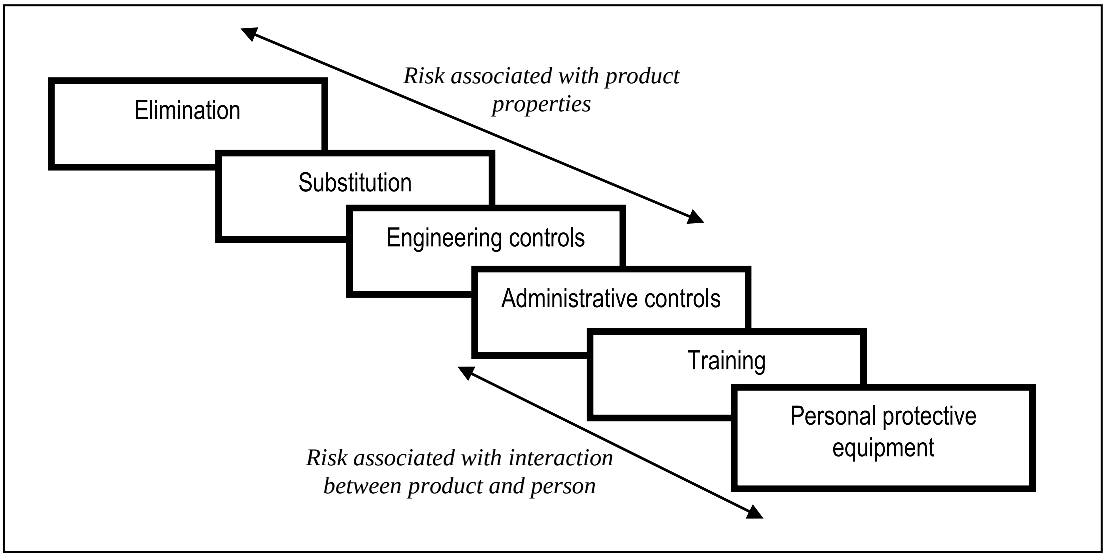
A comprehensive approach to prevention should acknowledge the causal explanation of the occurrence of injury. In order to describe the causal explanation of an injury, a logical sequence of the injury chain should be interrogated. Stevenson et al. (2004) argue that prevention activity is only appropriate when interruption in the chain of injury is possible (Stevenson, 2004).

An effective product safety initiative to reduce the risk associated with a product and to promote safety to the user is related to the ability of the intervention to prevent injury or damage. Such qualities of intervention are generated through a good quality risk assessment process, which involves the identification of all possible risk scenarios to properly specify all relevant product hazards. This process requires the regulators to comprehensively identify the potential hazards associated with the interaction between the person and the product, and/or the hazards associated with the product's properties (van Duijne, et al., 2008).

Haddon's matrix was developed to assist injury prevention programs to provide a comprehensive framework to understand the chain of injury (Section 3.2). This framework can help risk assessors to understand the role of the host (i.e. consumer), vector (i.e. product) and environment in the pre-event, event and post event (i.e. injury chain) (Stevenson, et al., 2004). Therefore, this framework provides a comprehensive approach to specify the causality of an injury event.

In the event of product-related injury, products are not always the main cause of injury. Farquhar et al. (1998) argue that one of the issues around product safety regulation in preventing injury is human failure, where consumers overlook the safety instructions which in turn, leads to product misuse (Farquhar, Barrow, Church, Fortin, & Bank, 1998). Therefore, the requirement to specify the involvement of products in injury events to determine causality is emphasised. While misuses of products are best addressed by the consumer, manufacturers of products are often able to predict the reasonably foreseeable misuse of the product and to make cost effective adjustment at the design and distribution stages of the product (Productivity Commission, 2006).

Understanding the product involvement in injury events also assists the regulators to determine the most appropriate type of intervention. A hierarchy of controls outlined in a risk management model (Figure 4-1) specifies the types of intervention tools that can be implemented depending on the causality characteristics of injury events. For example, in a case where injury is caused by the product's properties, an elimination of the product in the market could be undertaken. Alternatively, in the case where injury is caused by interaction between the user and the product (i.e. product misuse), administrative controls such as a labelling standard could be enforced to prevent such misuse.



Adapted from McIntosh, 2004 (McIntosh, 2004)

Figure 4-1 Hierarchy controls in risk management model

In 1984, the Australian Consumers' Association developed a taxonomy of product involvement which includes four classes: (1) Injury related to physical failure of product, (2) Injury related to inadequate design of the product, (3) Injury related to inadequate instructions, (4) Injury not related to any shortcoming in the product (Productivity Commission, 2006). As reported in the 2006 review of Australian product safety system, this taxonomy is not currently being used due to the inability of data to provide details that enable product involvement justification (Productivity Commission, 2006).

Another similar categorisation to determine product involvement has been developed in the European study conducted by the Institute Sicher Leben (Austrian Institute for Home and Leisure Safety) in 2000. The Product Involvement Factor (PIF) is a tool that has been used in the European injury surveillance System (formerly EHLASS) to interrogate the text narrative data by using a keyword matching method to group injury cases into seven 'involvement' categories (Bauer & Sector, 2000). For example, keywords such as 'defect', 'faulty', and 'broken' are used as indicators of faulty products whereas keywords such as 'careless', 'mistake', 'unsafe' indicate maladapted use of products (Bauer & Sector, 2000). In order to determine product causality, injury cases in the European injury surveillance System are categorised into seven groups based on the involvement of the product as described in the text narratives. These groups are as follows:

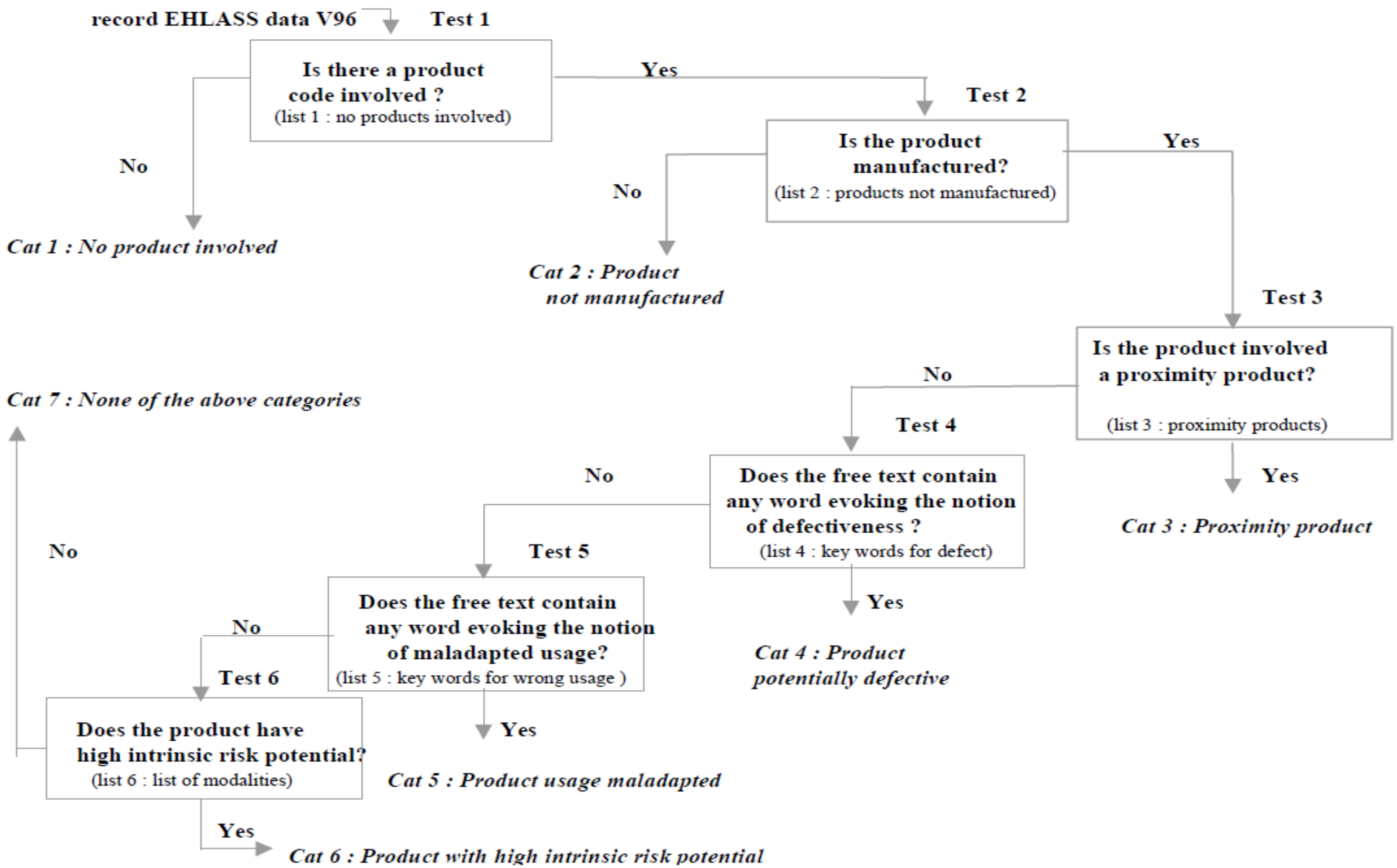
- PIF 1 No product involved
- PIF 2 Product non-manufactured
- PIF 3 Product related to proximity
- PIF 4 Product potentially defective
- PIF 5 Product potentially maladapted
- PIF 6 Product with high intrinsic risk
- PIF 7 Product identified but description inadequate to enable a judgement

(Bauer & Sector, 2000)

The likelihood of product causality involvement is considered for product-related injuries that are categorised under PIF 4 to 6. The application of the above categories in the European injury data showed a 5% rate of product causality. Approximately 17% of injury cases were related to proximity products.

These results were brought to the European product safety expert panel to determine preventability based on the PIF categorisation. Approximately 56% of product-related injury cases were associated with behavioural causes whereas 16% of cases were considered preventable by a technical safety solution (Bauer & Sector, 2000). The study, however, also found that preventability assessment of product-related injury cases can be an ambiguous task as the product safety expert panel could not interpret the results in the same manner (Bauer & Sector, 2000).

A current review of the Australian product safety system raises the importance of ensuring that injury data collected to support product safety provide details to explain product involvement in the event of injury or death, which can, in turn, be used to determine causation (Productivity Commission, 2006). In the existing injury data sources, coded data can provide information to support frequency and severity estimates. However, more information is needed to determine product causality. Narrative data as recorded in text fields in databases and in medical records are the best possible information source available to provide information about product involvement in the injury event to explain causation.



(Bauer & Sector, 2000)

Figure 4-2 Algorithm of PIF Classification

The use of narrative injury data to determine causality of injury cases may be associated with a degree of subjectivity. In order to reduce the subjectivity issue, a set of directive questions can be used to guide the determination of product causality. The algorithm of PIF classification (see Figure 4-2) used in Bauer and Sector's study provides a useful model of directive questions in assigning product involvement factor codes. However, there are several limitations of this model that are required to be acknowledged. Firstly, there has been no further study conducted since to validate the findings. Therefore, there has been no further development reported by the institute to improve this model and to address the limitations. Moreover, it was noted in the report that distinguishing between individual categories was difficult as definitions may have been overlapping in some injury scenario (Bauer & Sector, 2000). This contributed to the level of subjectivity of this classification system as the inclusions of proximity, defective products, maladapted and high intrinsic risk product categories can be overlapping. The hierarchy of questions in assigning PIF 3, 4, 5 and 6 is also subject to misclassification due to the order of questions in the hierarchy. For example, more cases may be prone to be classified under Category 3 for proximity due to its broad inclusion and its level in the question hierarchy Further adjustments to address this limitation have been applied for the current study. The details are provided in Chapter 7.

4.5 APPLICATIONS TO THE STUDY

Injury data is claimed to be one of the most vital needs to support a product safety system (Productivity Commission, 2006). Several successful examples of the use of injury data in other countries, such as in the U.S, Canada and the European Union countries, have been discussed in the literature review. However, in Australia, injury data are still underutilised to inform product safety initiatives. The literature review discussed several injury data sources, such as ED-based injury surveillance data and hospital admission data, as well as the potential approaches and techniques that can be used to interrogate the injury data to support the Australian product safety system. The current research aims to improve product safety information through the analysis of existing injury data to develop methods to enable prioritisation of responses by product safety regulators.

This research analysed the Queensland paediatric injury data collected between 2008 and 2010 sourced from the QISU and QHAPDC. While fatality data would enhance the quality of product injury information, the inclusion of such data is outside the scope of this study. The ED-based injury surveillance data and hospital admission data are considered more suitable to inform early warning surveillance for the product safety regulators as they form the earliest available point of data capture in the healthcare system. The injury data were analysed to identify and quantify the product-related injuries based on the three criteria of product safety prioritisation: frequency, severity and causality. Frequency of injuries is defined as the count or number of injury cases identified in the data to describe the magnitude of the injury burden (Driscoll, et al., 2004a). Severity of injury in this study is defined as the intensity of the damage to the body as a result of the injury event (Cryer, 2006), whereas causality is defined as the factors that contribute to the production of an injury occurrence (Stevenson, 2004).

The specific objectives of this research are:

1. To identify and quantify the frequency of product-related paediatric injuries in emergency presentations (Study I & II) and hospital admissions in Queensland (Study III).
2. To identify and quantify the severity of product-related paediatric injuries in emergency presentations (Study II) and hospital admissions in Queensland (Study III).
3. To identify and quantify the causality of product-related paediatric injuries in emergency presentations (Study II) and hospital admissions in Queensland (Study III).
4. To evaluate the extent of useful documentation in emergency department-based injury surveillance data and hospital records for product safety stakeholders (Study IV).
5. To develop methods for prioritising product-related injury mechanisms based on severity, frequency and causality measures. (Discussion)

In the frequency of product-related injury analysis, the proactive approach of identifying product-related injuries was used in the data analysis. In the proactive analysis, injury data was analysed to identify prominent issues portrayed by the injury data using product codes analysis.

In the severity of product-related injury analysis, several severity scoring systems that are currently used in healthcare settings as well as risk assessment process were used as tools to interrogate the injury data. The scope of the severity analysis focused on available severity indicators in injury and ED-based hospital admission data including triage, mode of separation length of stay and the ICISS's SRRs. The RAPEX severity rating was also applied to the hospitalisation burn data.

In the causality of product related injury analysis, the injury text narratives in ED-based injury surveillance (QISU) data were used to determine causality of product-related injuries using the Product Involvement Factor (PIF) adopted from the European Union's injury surveillance system. The causality analysis was not conducted on admission (QHAPDC) data due to the unavailability of text narratives in this dataset. The causality analysis was conducted in the data collected from the medical record review. The results of the frequency, severity and causality analyses were combined to develop the prioritisation method of the product safety issues.

In order to perform these analyses on the two Queensland's injury datasets, the PhD research was divided into four studies. The methodology and rationale of each study are outlined below:

Study I involved a preliminary analysis of injury data to identify and quantify product related injuries in QISU data using product-related codes. A secondary analysis of paediatric injury data was performed using data from the QISU collected between 1 January 2008 and 31 December 2010. This study used a proactive approach to identify the most prominent product-related injuries in QISU using codes analysis. This study focused mainly on frequency of injuries.

In the Study II, the analyses performed in Study I were extended through several in-depth secondary data analyses using QISU data. Data was analysed in terms of major mechanisms of injury and the three criteria of product safety prioritisation, frequency, severity and causality, were used to identify priority products. In the frequency of injury analysis, the study used codes analysis in proactive injury data analyses. Triage and Mode of Separation were used as the severity indicators. Text narratives were manually reviewed and categorised into the PIF categories. Results were combined to perform prioritisation of product safety issues based on frequency, severity and causality.

In the Study III, hospital admission data (QHAPDC) were analysed in terms of major mechanisms of injury and the two criteria of product safety prioritisation, frequency and severity. In the frequency of injury analysis, the study used codes analysis to proactively identify product safety issues based on the hospital admission data. Mode of Separation, length of stay and the ICISS's SRR were used as the severity indicators. Results were combined to perform prioritisation of product safety issues based on frequency and severity.

Study IV involved a retrospective on-site medical record review to identify any missing information that was not captured in the hospitalisation coded data. The aim of the study was to evaluate the extent to which medical records contain core product-relevant information beyond what is coded in routine data, and to identify the extent to which product involvement in injuries is documented.

The structure of this thesis and the results from each of the studies in each of the prioritisation criteria are summarised in the table below:

	Study I Secondary data analysis of ED-based injury surveillance data (coded data)	**Study II Secondary data analysis of ED-based injury surveillance data (coded data and text narratives)**	**Study III Secondary data analysis of hospital admission data**	**Study IV Medical record review**
Chapter 5 Frequency of product-related injury	Proactive identification of product-related injury in QISU data (Page 120, 123)		Proactive identification of product-related injury in hospital admission data (Page 121, 133)	
Chapter 6 Severity of product-related injury		ED-based injury surveillance based severity measures (Page 151, 161)	Hospitalisation based severity measures Product safety based severity measures (Page 153, 177)	
Chapter 7 Causality of product-related injury		Text narrative review of QISU data (Page – 202, 211)		Medical record review (Page 205, 226)
Chapter 8 Prioritisation of product-related injury	Prioritisation of product safety issues using frequency, severity and causality criteria based on QISU data analysis (Page 258)		Prioritisation of product safety issues using frequency and severity criteria based on hospital admission data analysis (Page 262)	

This research project provides information on techniques for interrogating health data (particularly ED-based injury surveillance and hospital admission data) to identify trends and patterns of product-related injury and to inform product safety prioritisation. This research also provides input into the development of health classification (i.e. ICD and NDS-IS) to improve the ability of coding systems to capture common products causing injury.

Chapter 5: Identification of product-related injuries

Chapter 5: Identification of product-related injuries

5.1 INTRODUCTION

This chapter focuses on identifying product-related injuries in injury data. A proactive approach was utilised in the secondary analysis of data obtained from two Queensland injury data sources. In this chapter, injury data were analysed to proactively identify product-related injuries using different techniques and to consequently prioritise areas of concern based on the frequency of injuries, specifically focussed on paediatric injury. Children were selected as the focus because of the reasons outlined in earlier chapters around vulnerability.

As highlighted in the literature review, there are several challenges in identifying and enumerating product-related injuries; especially children's injuries. First, injury data contain a vast array of injury types, some product-related and others non-product-related. Techniques and approaches are required to differentiate product-related injuries from other injuries. Secondly, injury data are commonly stored and coded based on health classifications which are designed for clinical and health statistical use. These classifications are often limited in their ability to classify cases based on the type of product causing the injuries. Several classifications that have been developed specifically for injury prevention purposes have better specification of products; however, the categories are limited to broad product types only. Another difficulty is also prominent when acquiring the frequency of product-related injuries from injury data across several types and levels of healthcare settings. This is due to the differences in health classifications and data items used in these various data sources. These differences make it difficult to get an overall picture of product-related injuries in particular population groups.

The study presented in this chapter utilised different techniques to identify product-related injuries using a proactive approach. A ***proactive approach*** in this case is defined as an enumeration process of all product-related injuries recorded in the data and identifying the type of product and/or injury with the highest frequency for prioritisation. When using this approach, ***product-relatedness*** is determined by identifying any documentation in the coded injury data that a product was involved as a direct or indirect cause of the injury. The analysis was conducted to interrogate two injury data sources: Queensland hospital admission data and the emergency department (ED) based injury surveillance data to answer the following research questions (RQ):

> **RQ 5.1**: What proportion of children's injuries are related to consumer products and how does this differ by age, gender and geographical location? (Proactive approach) (Study I& III)
>
> **RQ 5.2**: What are the most common product categories that are involved in injuries in children? (Proactive approach) (Study I & III)

5.2 METHOD

5.2.1 Case selection and data fields

A secondary analysis of paediatric injury data, for children aged 0 – 17 years old, was performed using data from the QISU and the QHAPDC collected between 1 January 2008 and 31 December 2010. Data obtained from both databases were filtered based on the intention of injury, eliminating assault, self-harm and undetermined intent. However, all injury cases amongst children under the age of 12 years old coded as self-harm were still included. This is to account for those unintentional self-harm injuries which may be miscoded as self-harm in injury data (i.e. children who ingested foreign body objects or household chemicals).

There are some overlaps in both datasets as injury cases in QISU data also contain injury cases that were later admitted to the hospital after being treated in the emergency department. These cases were retained in the data analysis as the study focused on exploring the overall characteristics of injuries and structure of each dataset to inform ongoing information system improvements within the product safety system. Furthermore, both QISU and QHAPDC data are episode-based, not person-based. Therefore, there is the possibility of a patient's re-presentation that has not been considered in this study.

The data fields which were used to identify product-related injury in QHAPDC data were principal diagnosis and external cause. Other data fields such as age, gender, postcode of usual residence were also used in the descriptive analysis. Similarly, the Major Injury Factors (MIF) field was used to identify product-related injury in QISU data. Other data fields such as age, gender, postcode of usual residence and mechanism of injury in QISU data were also used in the descriptive analysis.

Both datasets were grouped based on age where groupings were designed to match the current product safety regulations on toy products and also to consider the cognitive and physical developmental stages in childhood. In consideration of the many product-specific regulations in Australia which explicitly address children up to the age of 36 months (3yrs), the age brackets used in this study were grouped into 3-year (inclusive) intervals in order to keep consistency. The exceptions to this categorisation were in:

a) children under the age of 1, who were grouped distinctively from other age groups under the assumption that the type of products used among this age group would be vastly different to others, and

b) the last age group (16-17), where only 2 consecutive ages were present due to data being limited to children under the age of 18.

As a result of these determinations, the age groups used in this study were:

- <1 year old
- 1-3 years old
- 4-6 years old
- 7-9 years old
- 10-12 years old
- 13-15 years old
- 16-17 years old

5.2.2 Procedure

The study was conducted in two phases to identify the frequency and types of product-related injury. Phase one was a proactive approach using a secondary analysis of QISU and Phase two was a proactive approach using a secondary analysis of QHAPDC data.

Phase 1 – Proactive identification of product-related injuries in ED-based injury surveillance data

A proactive approach was utilised to identify product-related injuries in QISU data. The process of proactive searching for product-related injuries in QISU data (RQ 5.1 and RQ 5.2) involved code mapping and data re-coding (Figure 5-1). First, a range of Major Injury Factor (MIF) codes were mapped into categories based on their product safety relevance (i.e. whether they were products under the product safety regulatory framework or not) (Stage 1). Descriptions of MIF codes provided in NDS-IS Manual were used to assist this process. Assistance in the code selection process was provided by product safety experts who are members of the Queensland Consumer Product Injury Research Advisory Group (CPIRAG) – a group of university researchers, product safety regulators and government bodies who meet monthly to discuss issues of concern in relation to product safety in Queensland and nationally.

The mapping of MIF codes to flag product-related injuries was conducted by categorising the external cause codes into four categories of product flag:

- **Product**, which includes injury factors that involve consumer products covered by the product safety regulator
- **Possible product**, which includes injury factors involving unknown objects ('unspecified' codes) or objects that cannot be specifically coded under MIF codes, therefore coded under residual codes ('other specified').
- **Other regulator**, includes injury factors that involve objects that are covered by other regulators such as transport, medications and food
- **Non-product**, includes injury factors that are related to natural objects such as animals, plants, persons and weather

The list of mapped MIF codes is provided in Appendix 3.

Accordingly, injury cases were re-coded based on the mapped MIF codes and a new variable was made to flag product-related cases (stage 2). This process enabled product-related injuries to be quantified and correspondingly ranked based on the frequency of injury cases where the products were coded in QISU data (stage 3).

Common products involved in injuries were identified based on age, gender and geographic location (RQ1). For geographic location, the study used post codes of usual residence which were re-coded based on their remoteness using the Accessibility/Remoteness Index of Australia (ARIA).

An in-depth analysis was conducted on the identified product-related injuries to examine the mechanisms of injuries and to identify the common types of products involved in these injuries. All product types captured by the MIF codes were extracted from the code descriptions and tabulated to identify the most common types of products.

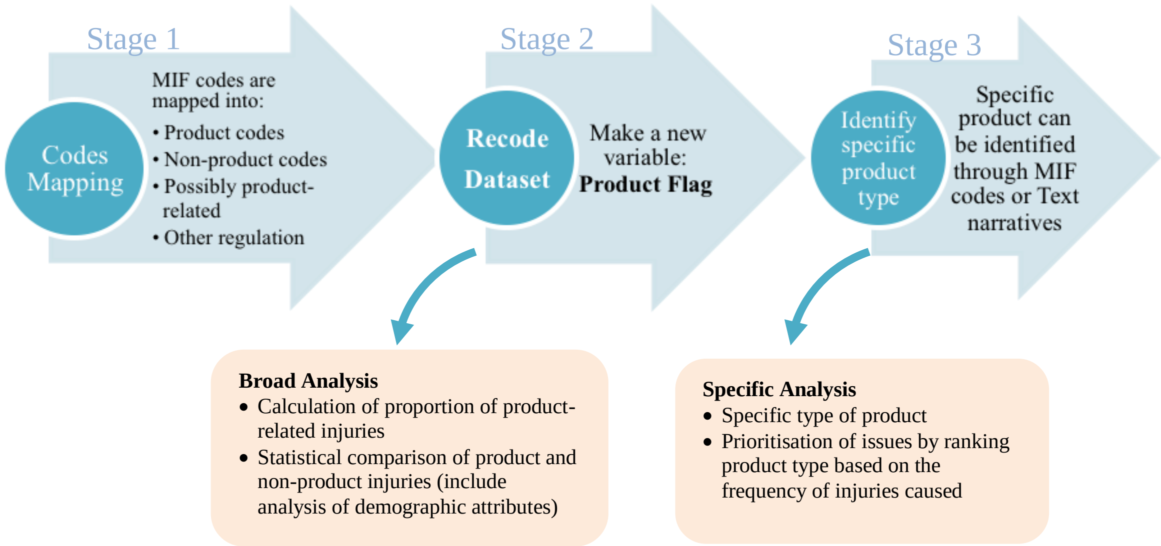


Figure 5-1 Proactive identification of product-related injuries in QISU data

Phase 2 – Proactive identification of product-related injuries in hospital admission data

A proactive approach was utilised to identify product-related injury in QHAPDC data (RQ 5.1 and RQ 5.2) involving code mapping and data re-coding (Figure 5-2). In stage 1, a range of International Statistical Classification of Disease and Related Health Problems, Tenth revision Australian Modification (ICD-10-AM) external cause codes were mapped into categories based on their product safety relevance (i.e. whether they were products under the product safety regulatory framework or not). Descriptions of codes provided in the ICD-10-AM Tabular list were used to assist this process. Assistance in the code selection process was provided by product safety experts who are members of the Queensland Consumer Product Injury Research Advisory Group described previously.

The mapping of ICD-10-AM external causes to flag product-related injuries was conducted by categorising the external cause codes into four categories of product flag:

- **Product**, which includes external causes that involve consumer products covered by the product safety regulator. A range of ICD-10-AM codes under transport accidents that specify pedal cycle and off-road motorcycles such as ag-bike, dirt bike and trail bike were also included in this product group as these transportation devices come under the jurisdiction of product safety regulators.

- **Possible product**, which includes external causes involving unknown objects ('unspecified' codes) or objects that cannot be specifically coded under ICD-10-AM external cause codes, therefore coded under residual codes ('other specified').

- **Other regulator**, includes external causes that involve objects that are covered by other regulators such as transport, medications and food.

- **Non-product**, includes external causes that are related to natural objects such as animals, plants, persons and weather.

The outcome of this mapping process is provided in Appendix 4. Accordingly, injury cases were re-coded based on the mapped external cause codes and a new variable was made to flag product-related cases (stage 2). This process enabled product-related injuries to be quantified and correspondingly ranked based on the frequency of injury cases where the products were coded as the external cause of the injury (stage 3).

Common products involved in injuries were identified based on age, gender and geographic location (RQ1). For geographic location, the study used post codes of usual residence which were re-coded based on their remoteness using the Accessibility/Remoteness Index of Australia (ARIA). A Multivariable Logistic Regression was used to predict the occurrence of product-related injury based on demographic characteristics (age, gender and geographic location). The purpose of this statistical analysis was to investigate how the proportion of product-related injuries differed by age, gender and geographic locations, to inform the targeting of product safety initiatives in vulnerable groups or locations.

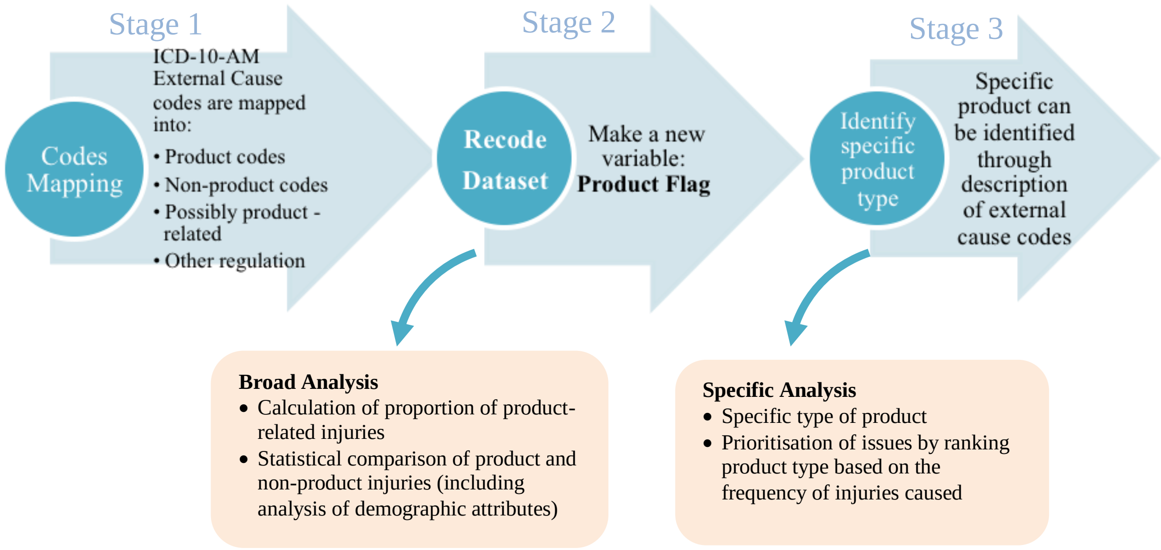
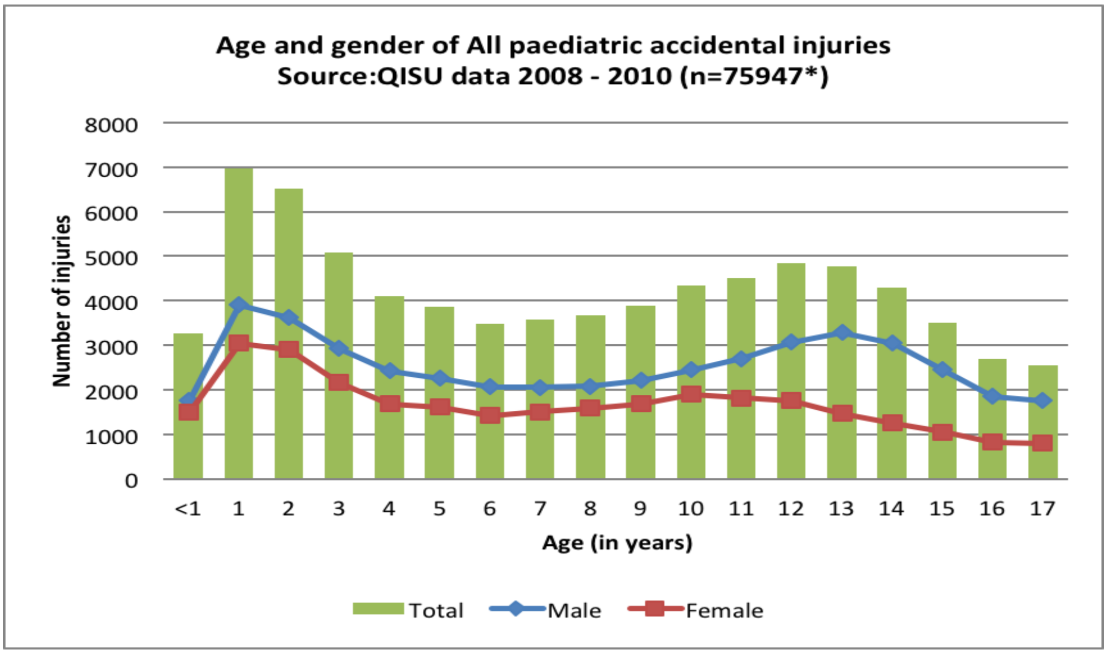


Figure 5-2 Proactive identification of product-related injuries in QHAPDC data

5.3 RESULT

5.3.1 Proactive Identification of product-related injury data in ED-based injury surveillance data

Overall, there were 75947 unintentional paediatric injuries recorded in ED-based injury surveillance data between January 2008 and December 2010. Twenty of these cases were coded under self-harm, however were included in the data analysis as they were cases amongst children under the age of 12 years old and therefore fell within the scope of the study, as described in an earlier section. The mean age of all ED-based injury surveillance cases of paediatric unintentional injuries was 8 years old. As seen in Figure 5-3, children aged 1 year old (9.2%, 6979 cases) formed the largest proportion of all child injuries. The second highest proportion was accounted for by children aged 2 years old (8.6%, 6512 cases). Infants under one year old (4%, 3259 cases) represented the smallest proportion amongst all children age groups. There were more male (60%, 45908 cases) than female children (40%, 30029 cases)



* Gender and age were unspecified in 10 cases

Figure 5-3 ED-based injury surveillance data: Overall injury by age and gender

Product-relatedness

Overall, as shown in the pie chart Figure 5-4, the identification of product-related injuries based on MIF codes showed approximately 39% (29844 cases) of all paediatric injuries were related to consumer products compared to 34% (25891 cases) non-product injuries. Approximately 19% (12055) were coded under residual codes in which the involvement of consumer product was unable to be determined and 11% (8157 cases) were coded under MIF codes identified as products not regulated by product safety regulator.

Further study has been conducted using the ED-based injury surveillance data to manually review the text narrative where residual codes were assigned (possible product group) and to identify the object types involved in these injuries (See Appendix 7). The review identified approximately 15% of cases coded under the residual code were related to consumer products which were not included in the codes list or were miscoded.

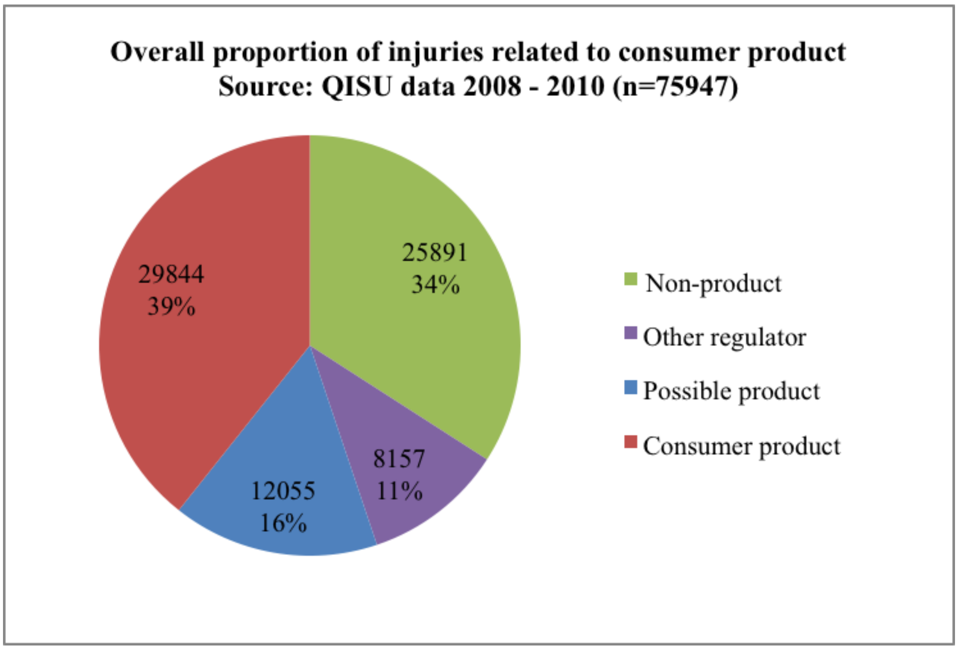


Figure 5-4 ED-based injury surveillance data: Pie chart of product-relatedness

Product-relatedness & Age

The four product categories were analysed by age group to identify differences by age (Figure 5-5). The proportion of product-related injuries ranged from 27% to 50% across all age groups. Infants (< 1 year old) had the highest proportion of product-related injuries, accounting for 50% of all accidents in this age group, even though the number of injuries in the age group (3259 cases) was the lowest compared to other age groups (χ^2 = 1902.86, p < 0.001). Children aged 4 – 6 years old had the second highest percentage of product-related injuries (46%). This was followed by children in the 1 – 3 years age group in which the proportion of product-related injuries was 41%. The lowest proportion (27%) of product injuries were in older children aged 16 -17 years old. The proportion of possible product injuries was the highest amongst children aged 16 – 17 years old (20%) and lowest amongst the infants (14%).

Compared to other categories, product-related injuries in each age group accounted for the highest proportion in younger age groups 0 – 9 years old. In contrast, older children aged 10– 17 years old had non-product injuries as the highest proportion.

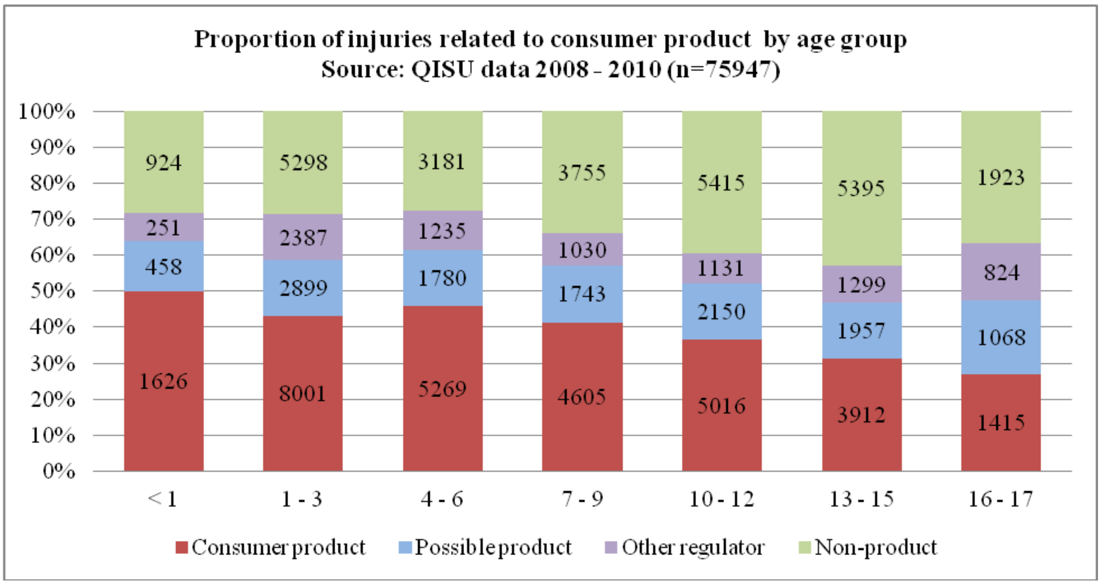
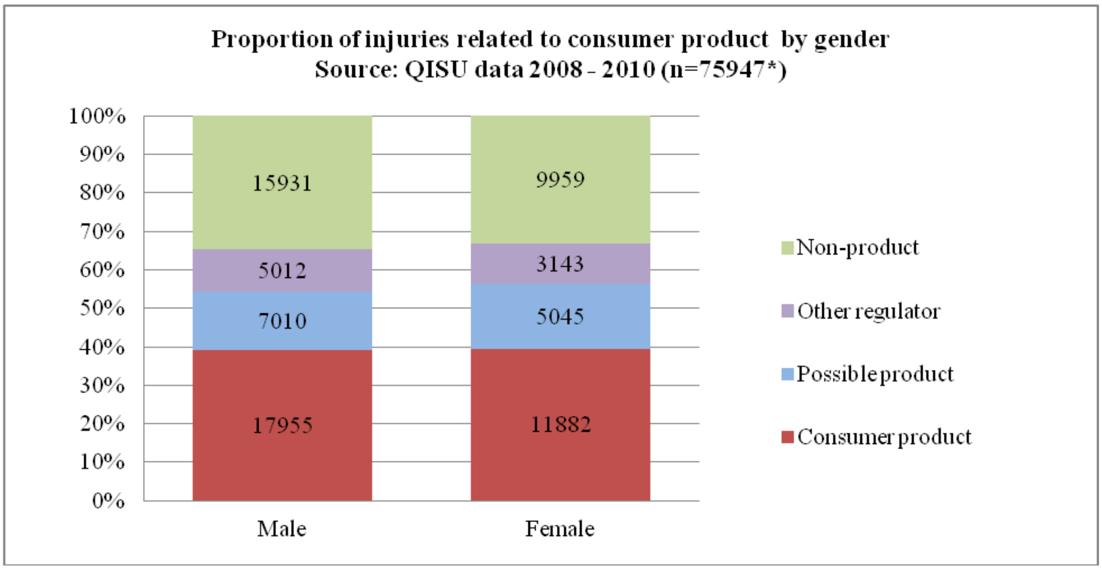


Figure 5-5 ED-based injury surveillance data: Breakdown of product-relatedness by age group

Product-relatedness & Gender

The four product flag categories were analysed by gender to identify any differences (Figure 5-6). Product-related injuries accounted for the highest proportion of injuries compared to other categories in both genders. Even though the number of product injuries was higher in males (45908 cases) compared to females (30029 cases), there was no significant difference in the percentage of product-related injuries (40% in female and 39% in males) (χ^2 = 43.8, $p < 0.001$). The proportions of other categories in both genders were also similar.

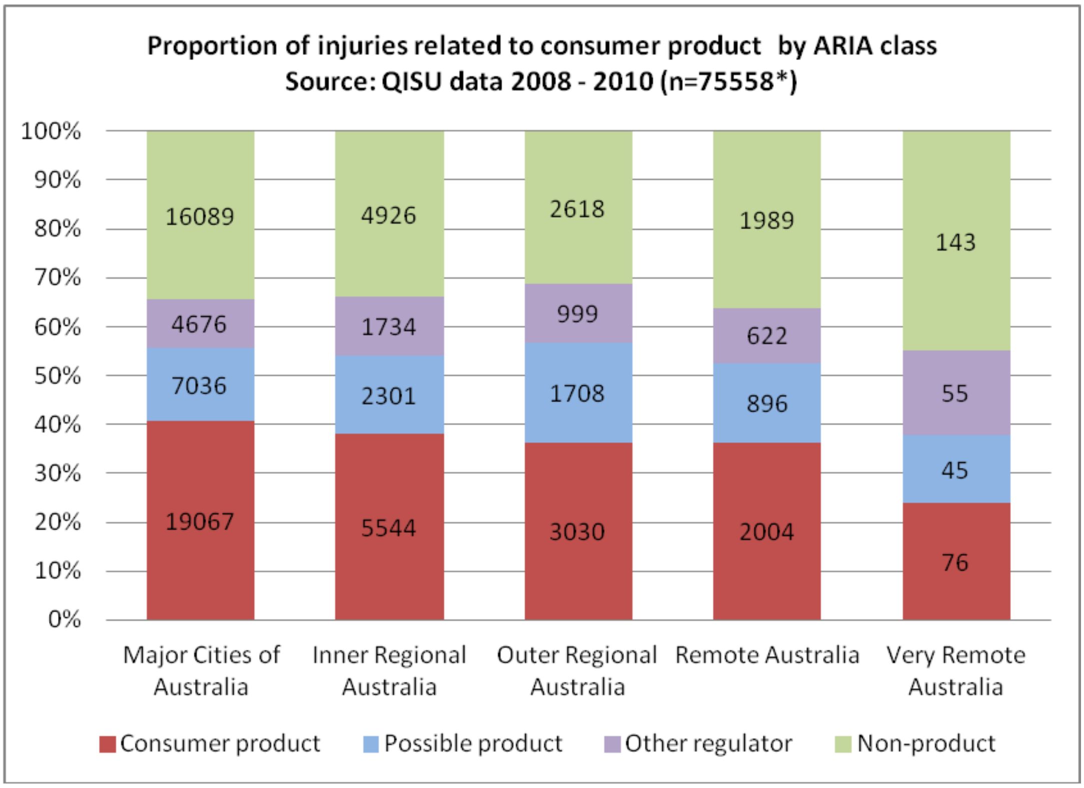


* Gender was missing in 10 cases

Figure 5-6 ED-based injury surveillance data: Breakdown of product-relatedness by gender

Product-relatedness & Geographic location

The four product flag categories were also analysed by geographic location of usual residence to identify any differences by remoteness (Figure 5-7). Geographically, the involvement of a consumer product as the major factor in paediatric injury was shown to decrease by remoteness of geographic location shown in the ARIA classes. As shown in the figure below, the count and percentage of product injuries were the highest (41%) in major cities and lowest in very remote areas (24%) (χ^2 = 318.91, $p < 0.001$). Apart from these two ARIA classes, the proportion of product-related injuries in major cities and regional areas were the highest compared to other categories.



* ARIA Class was not able to be assigned to 389 cases due to incorrect or missing postcodes

Figure 5-7 ED-based injury surveillance data: Breakdown of product-relatedness by ARIA class

Multivariate Logistic Regression

The overall paediatric injuries recorded in ED-based injury surveillance data were analysed to identify the association of product-relatedness with demographic characteristics: age, gender and geographical location. For this purpose, the outcome variable of product-relatedness was limited to two categories: non-product and consumer product, excluding the possible product and other regulator groups. Possible product group was excluded as it may contain both product and non-product-related injuries that cannot be confirmed due to insufficient information. The 'Other regulator' group was also excluded to focus the analysis on consumer products under the product safety regulation. Therefore, only 55735 cases grouped under the two categories were included. Another 256 cases were excluded due to missing values.

After mutual adjustment for all variables included in the model, ARIA class and age were significant predictors of product-relatedness. The odds of a product-related injury in major cities were 13% higher than remote areas (95% CI, 1.06 – 1.2). Similarly, the odds of a product-related injury in regional areas were 20% higher than remote areas (95% CI, 1.12 – 1.29). Age was associated with a decrease in the odds of product-relatedness where an increase in age is associated with 6% reduction in the odds of product-related injury. In the multivariate analysis, gender differences in the number of product-related injuries appeared to be not significant ($p>0.001$) (Table 5-1).

Table 5-1 ED-based injury surveillance data: Predictors of product-relatedness

Predictors	**N(%) of product-related injuries**	**Mean(Sd)**	**Odds Ratio**	**95% CI**	**Sig**
Gender					
- Male	17955(53%)		1.01	0.98-1.05	0.431
- Female	11882 (54%)		1	Referent	
Geographic Location	19067 (54%)		1.13	1.06 – 1.2	<0.001
- Major cities	8574 (53%)		1.2	1.12 – 1.29	
- Regional	2080 (49%)		1	Referent	
- Remote					
Age (0-17)		7.78 (5.06)	0.94	0.937– 0.944	<0.001

Injury Mechanisms & Product Types

An in-depth analysis of the 29844 product-related cases was performed by identifying the mechanism of injury and the product type using mechanism and MIF codes. The result of the analysis (Figure 5-8) showed that involvement of products was commonly identified in several mechanisms of injuries including falls, struck against object, crushing and piercing, acute over exertion, foreign body, thermal effect, chemical effect and electrical effect. The frequency of injuries in different mechanisms differed by age. Younger children were more likely to be injured by almost all mechanism of injuries compared to older children.

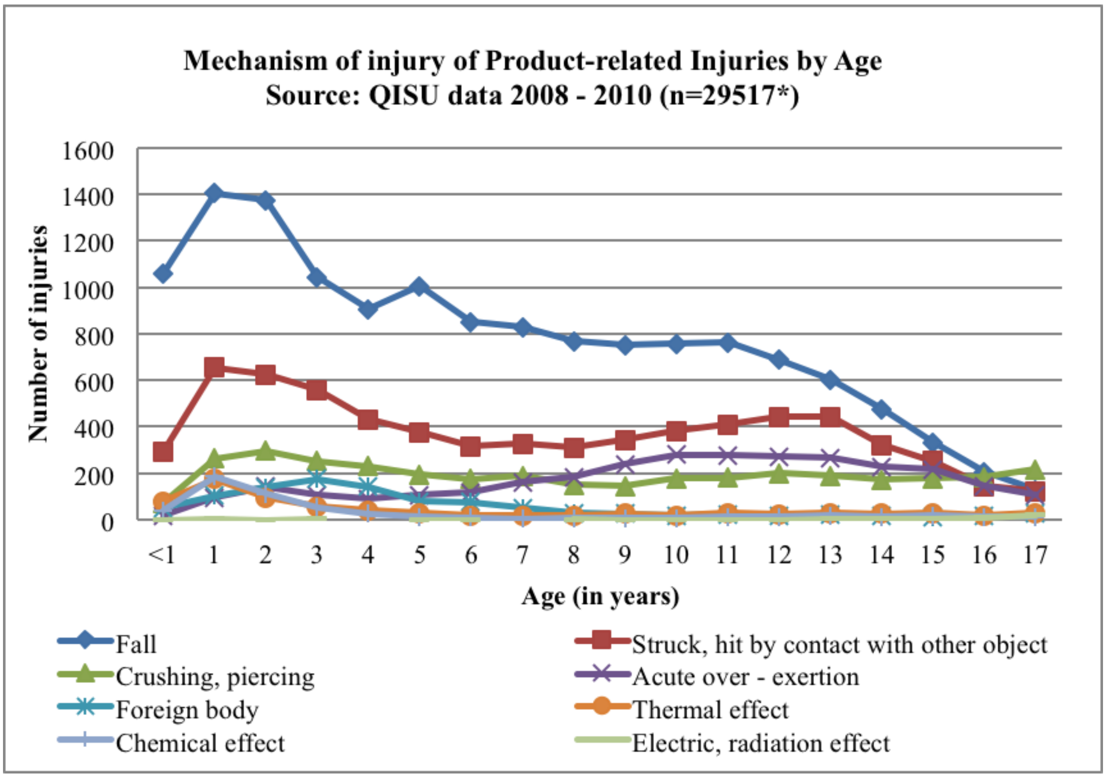


Figure 5-8 Mechanism of injury of product-related injuries by age

Falls were found to be the most frequent mechanism of injury in ED-based injury surveillance data, causing 47% (13940 cases) of all product-related injuries. The frequency of fall ED attendances reduced by the age of the children with a peak at 1 - 2 years old. The types of product causing these falls varied in different age groups. The majority of product-related falls were associated with furniture, infant/child products, sporting equipment and off-road transport vehicles like bicycles and off-road motorcycles. Furniture falls accounted for 28% (4645 cases) of all product-related falls. Within this group, children aged 1 – 6 years old accounted for 70% (2703 cases) of all injuries related to furniture falls. The second most common product-related to falls was infant or child products (27%, 3725 cases) in which younger children aged 1 – 9 years old accounted for 79% (2944 cases). Infant/child products include a range of playground equipment, toys and nursery products. Falls in older children aged 7 – 15 years were commonly related to sporting equipment and off-road transport vehicles such as bicycles, skateboard, non-motorised scooter and roller-skates.

The second most common external cause was struck or hit by other objects, which accounted for 23% (6724 cases) of all product-related injuries. The frequency of these injuries was high amongst the 1 – 3 year old group (27%, 1831 cases) and those in 10 – 12 year old group (18%, 1232 cases). The types of products involved in the ‘struck or hit by’ mechanisms were different in each age group. Sporting equipment accounted for the highest frequency of injuries amongst the 10 – 12 year olds. Meanwhile, furniture products accounted for the highest frequency of injuries amongst the 1 – 3 year olds.

Table 5-2 ED-based injury surveillance data: Mechanism of injury and product types by age group

Mechanism of injury and product involved in the injury	Age (in years)							Total
	< 1	1 - 3	4 - 6	7 - 9	10 - 12	13 - 15	16 - 17	
Fall	**1062**	**3824**	**2757**	**2347**	**2205**	**1411**	**334**	**13940**
Furniture	618	1997	706	283	141	83	27	3855
Infant or child's product	405	1094	1095	755	305	65	6	3725
Sporting equipment	5	376	503	676	927	621	134	3242
Transport (off-road)	2	154	370	575	784	612	148	2645
Utensil or container	28	126	31	17	7	9	5	223
Tool		25	18	10	7	7	6	73
Food drink, personal use item		15	7	12	16	2	6	58
Miscellaneous		4	10	17	13	9		53
Appliance	4	26	12	1	4	2	1	50
Structure or fitting		6	5	1	1		1	14
Chemical substance		1				1		2
Struck, hit by contact with object	**290**	**1831**	**1118**	**975**	**1232**	**1014**	**264**	**6724**
Sporting equipment	10	133	220	393	747	625	131	2259
Furniture	163	1062	377	205	150	104	23	2084
Infant or child's product	57	297	224	116	79	23	3	799
Transport (off-road)	8	89	132	137	138	141	38	683
Utensil or container	17	88	56	34	34	25	11	265
Tool	3	23	26	21	31	33	41	178
Appliance	16	81	33	12	11	14	5	172
Structure or fitting	13	31	28	24	10	11	2	119
Food drink, personal use item	1	11	14	25	21	27	2	101
Chemical substance	1	13	6	5	4	6	8	43
Miscellaneous	1	3	2	3	7	5		21
Crushing, piercing	**73**	**809**	**595**	**481**	**553**	**537**	**397**	**3445**
Utensil or container	24	232	173	144	190	198	188	1149
Tool	3	57	58	84	91	134	102	529
Transport (off-road)	1	94	109	81	103	56	34	478
Furniture	22	182	81	46	39	20	12	402
Sporting equipment	1	48	55	52	64	64	22	306
Infant or child's product	8	105	66	24	15	4	1	223
Appliance	6	44	11	9	16	22	13	121
Structure or fitting	4	30	27	23	6	15	11	116
Food drink, personal use item	2	12	12	14	21	15	9	85
Miscellaneous	1	5	3	4	6	9	4	32
Chemical substance	1				2		1	4
Acute over-exertion	**19**	**340**	**310**	**579**	**824**	**706**	**250**	**3028**
Sporting equipment		81	122	314	508	488	149	1662

Mechanism of injury and product involved in the injury	Age (in years)							Total
	< 1	1 - 3	4 - 6	7 - 9	10 - 12	13 - 15	16 - 17	
Infant or child's product	7	91	95	109	91	16		409
Transport (off-road)	1	12	33	81	112	126	43	408
Furniture	10	143	50	60	77	41	22	403
Tool		4	2	3	4	7	20	40
Food drink, personal use item	1	2	4	2	13	10	3	35
Utensil or container		1	1	4	7	7	10	30
Miscellaneous			1	5	8	8		22
Appliance		5	1		2	2	3	13
Structure or fitting		1	1	1	1	1		5
Chemical substance					1			1
Foreign body	**50**	**417**	**294**	**105**	**57**	**52**	**41**	**1016**
Food drink, personal use item	9	185	138	56	26	9	7	430
Infant or child's product	21	165	114	23	2			325
Tool	4	21	13	2	4	8	27	79
Sporting equipment	2	6	9	9	14	13	2	55
Chemical substance	4	22	4	3	3	5	2	43
Miscellaneous	5	6	2	8	4	12	1	38
Utensil or container	3	8	9	1	2	2	1	26
Furniture		2	4	1	1		1	9
Appliance	1	2	1			2		6
Transport (off-road)				2	1	1		4
Structure or fitting	1							1
Thermal effect	**78**	**322**	**86**	**59**	**64**	**81**	**46**	**736**
Appliance	67	228	42	28	13	17	9	404
Transport (off-road)	1	36	13	12	13	14	3	92
Food drink, personal use item	2	13	6	5	14	17	13	70
Chemical substance		4	5	4	17	20	11	61
Utensil or container	3	17	7	5		4	6	42
Sporting equipment	2	4	8	2	1	1		18
Tool	1	7	1	1	1	3	4	18
Miscellaneous	1	3	2	2	3	3		14
Infant or child's product		5	1		1	2		9
Furniture	1	4	1		1			7
Structure or fitting		1						1
Chemical effect	**39**	**352**	**48**	**17**	**33**	**48**	**24**	**561**
Chemical substance	38	342	43	17	33	46	22	541
Food drink, personal use item		5	2				2	9
Infant or child's product	1	4	2					7
Tool		1	1			1		3
Sporting equipment						1		1
Other and unspecified mechanism	**5**	**80**	**53**	**38**	**45**	**46**	**23**	**290**
Sporting equipment		14	11	15	18	24	7	89
Infant or child's product	4	27	17	3	6	2	1	60
Food drink, personal use item	1	8	7	5	1	7	7	36
Furniture		11	5	7	2	3	1	29
Transport (off-road)			6	3	7	6	2	24
Chemical substance		9	3	2	4	2	1	21
Appliance		5		1	3		1	10
Tool		2	1		2	1	3	9
Miscellaneous		1	2	2		1		6
Utensil or container		2	1		2			5

Mechanism of injury and product involved in the injury	Age (in years)							Total
	< 1	1 - 3	4 - 6	7 - 9	10 - 12	13 - 15	16 - 17	
Structure or fitting		1						1
Electric, radiation effect	**1**	**10**	**2**	**3**	**3**	**14**	**34**	**67**
Tool		1				8	31	40
Appliance	1	9	2	3	3	6	3	27
Suffocation	**9**	**15**	**5**	**1**		**2**	**1**	**33**
Infant or child's product	8	7	1					16
Food drink, personal use item		6	2	1				9
Sporting equipment			1			1		2
Utensil or container	1		1					2
Transport (off-road)		1						1
Chemical substance							1	1
Appliance						1		1
Furniture		1						1
Biohazard (contact, splash, spill)		**1**	**1**			**1**	**1**	**4**
Chemical substance		1	1			1	1	4
Total	**1626**	**8001**	**5269**	**4605**	**5016**	**3912**	**1415**	**29844**

5.3.2 Proactive Identification of product-related injury data in hospital admission data

Overall, between January 2008 and December 2010, Queensland hospital admission data recorded 58309 paediatric cases with unintentional causes of injuries. Twenty two of these cases were coded under intentional self-harm, however they were grouped with the unintentional injuries for this analysis and included in the data analysis as they were cases amongst children under the age of 12 years old. The mean age of all paediatric admissions due to unintentional incidents was 8 years and 8 months. As shown in Figure 5-9, children aged 1 year old accounted for the highest peak of paediatric hospitalised injuries with a total of 4391 cases representing approximately 7.5% of all paediatric hospitalised injuries. The second highest was in children aged 2 years old with 4123 cases representing approximately 7% of all paediatric injuries and third highest in children aged 17 years old (6.6%, 3879). Infants under the age of 1 year old accounted for the lowest proportion (4%) of all paediatric hospitalised injuries with 2313 injury cases. The majority of injured children were male (66%, 38202 cases).

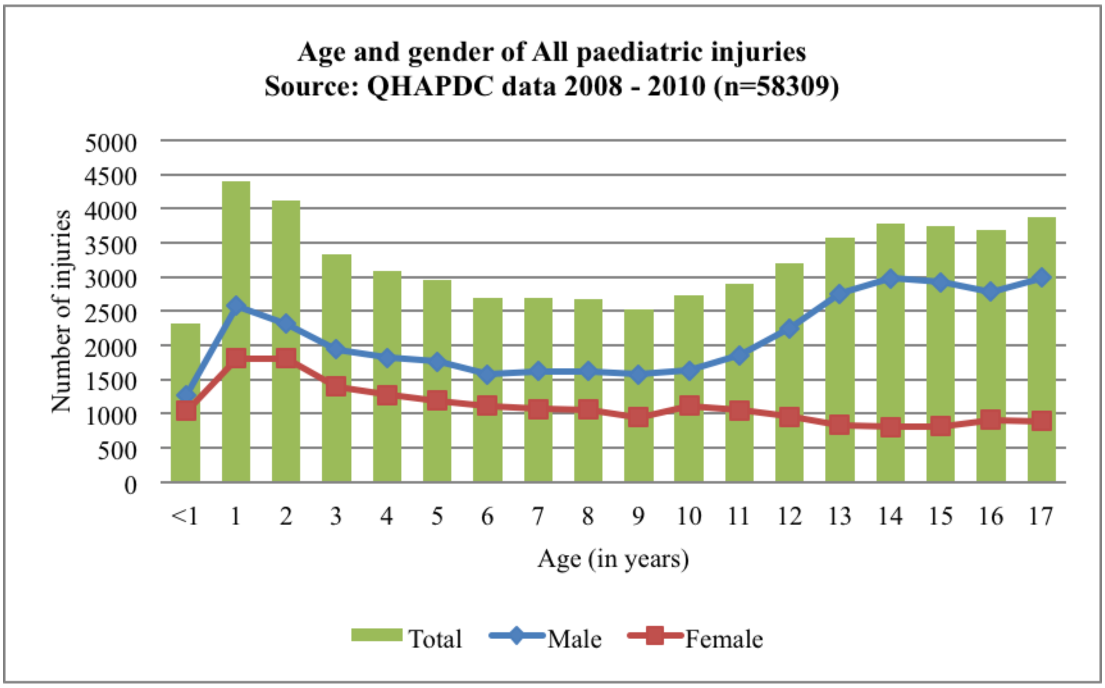


Figure 5-9 Hospital admission data: Overall age and gender of paediatric accidents

Product-relatedness

The 2008 – 2010 paediatric hospital admission data were re-coded into the product-relatedness categories based on the mapped ICD-10-AM external cause codes. The outcome of the re-coding process shows that approximately 32% (18754 cases) of all paediatric hospitalised injuries recorded in hospital admission data were related to consumer products (Figure 5-10). Approximately 29% (17037 cases) were grouped under ‘possible product’ as the descriptions of codes in this group were not specific enough to determine whether the object involved in the injury was a product or not. In the following statistical analysis, cases in this group were excluded. Injuries in which objects involved were identified as products regulated under other regulatory bodies were grouped under ‘Other regulators’, accounting for approximately 21% (12302 cases). The remaining 18% (10216 cases) were related to non-product objects.

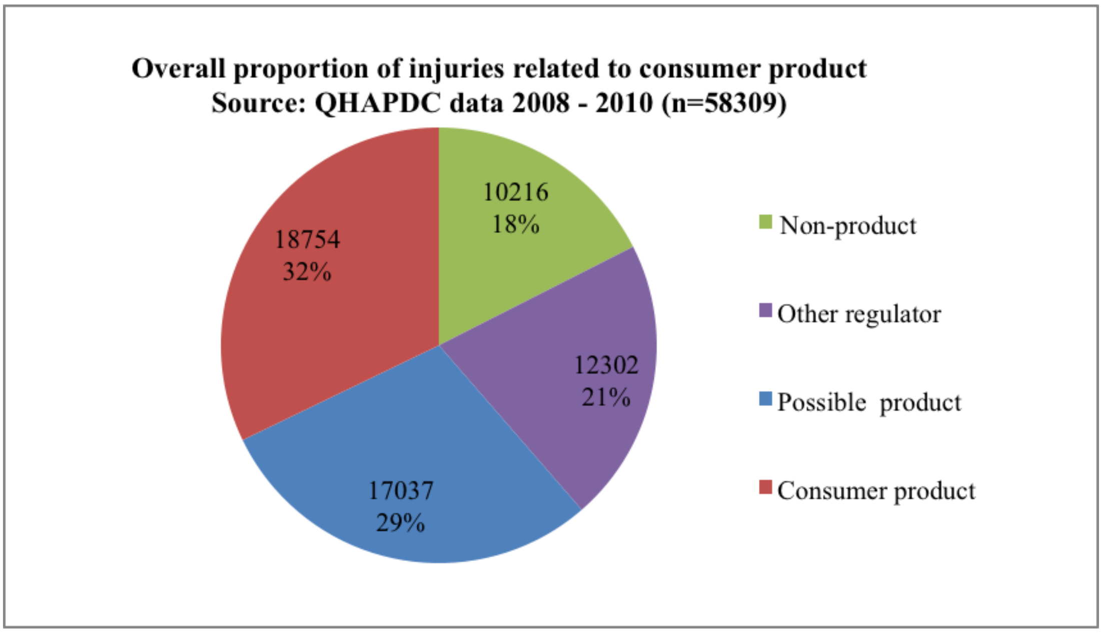


Figure 5-10 Hospital admission data: Pie chart of product-relatedness

Product-relatedness &Age

The four product flag categories were analysed by age group to identify differences by age (Figure 5-11). The proportion of product-related hospitalised injuries ranged from 24% to 38% across all age groups. Children aged 4 – 9 years old had the highest proportion of product-related injuries, accounting for 38% of all accidents in this age group (χ^2 = 1497.88, $p < 0.001$). Infants under the age of 1 year old had the second highest percentage of product-related injuries (36%), even though the number of hospitalised injuries in the age group (815 cases) was the lowest compared to other age groups (Figure 5-9). In contrast, even though the number of product-related injuries was the highest amongst children aged 1 – 3 years old (3458 cases), the proportion of these injuries (29%) that were deemed to be product related was relatively low compared to other age groups. The lowest proportion of product injuries were in older children aged 16 -17 years old (24%). The proportion of possible product injuries was the highest amongst children aged 4 – 6 (32%), 1- 3 (31%) and 16 - 17 (31%) compared to other age groups.

Compared to other categories, product-related injuries in each age group accounted for the highest proportion, except for the children in 1 – 3 and 16 – 17 year old groups, in which possible product injuries accounted for the highest proportion.

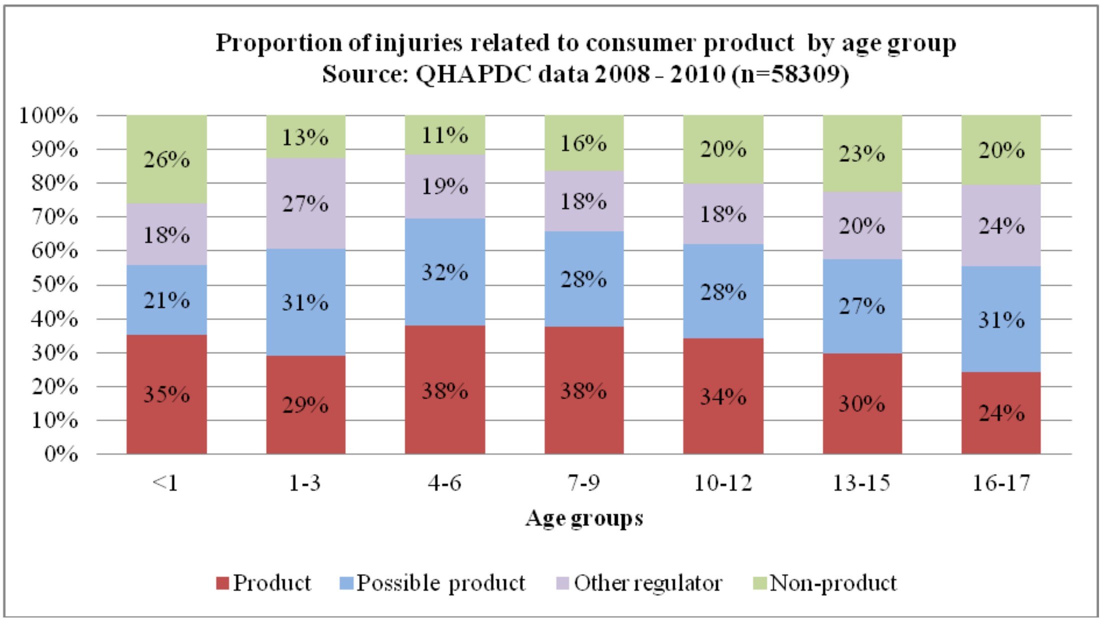


Figure 5-11 Hospital admission data: Breakdown of product-relatedness by age group

Product-relatedness & Gender

The four product flag categories were separated by gender to identify any differences (Figure 5-12). Product-related injuries accounted for the highest proportion of hospitalised injuries compared to other categories in both gender. Even though the number of product injuries was twice as high in males (12513 cases) compared to females (6241 cases), there was no significant differences in the percentages of product-related injuries (31% in female and 33% in males) (χ^2 = 44.34, $p < 0.001$). The proportions of other categories in both genders were also similar.

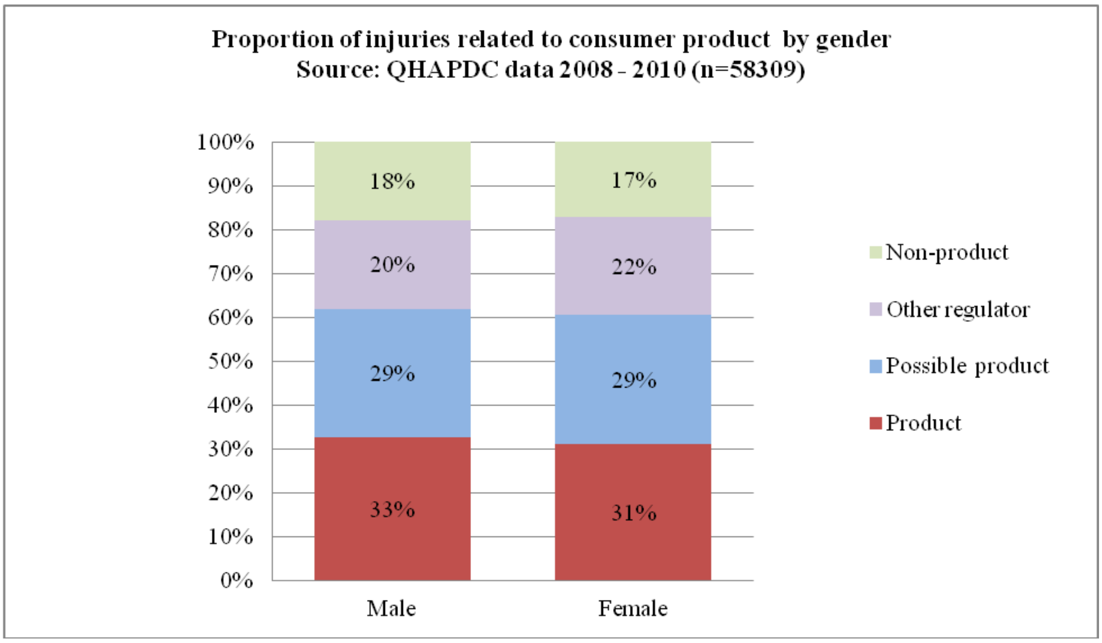


Figure 5-12 Hospital admission data: Breakdown of product-relatedness by gender

Product-relatedness & Geographic location

The four product flag categories were also analysed by geographic locations to identify any differences relating to remoteness (Figure 5-13). The proportion of product-related hospitalised injuries was reduced by the remoteness of geographic location shown in ARIA classes. The count and percentage of product injuries were the highest (33%, 10058 cases) in major cities and lowest in very remote areas (17%, 136 cases) ($\chi^2 = 340.45$, $p < 0.001$). The proportion represented by the possible product category however, was high in remote and very remote areas with 30% (351 cases) and 48% (397 cases) of injuries being coded under possible product. Apart from these two ARIA classes, the proportion of product-related injuries in major cities and regional areas were the highest compared to other categories.

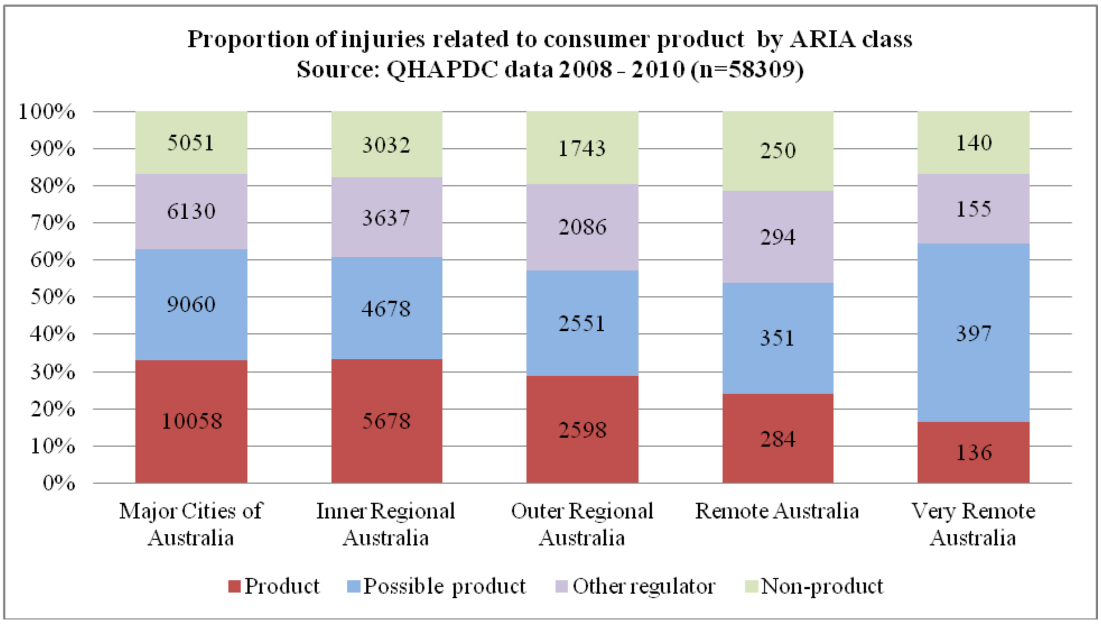


Figure 5-13 Hospital admission data: Breakdown of product-relatedness by geographic location

Multivariate Logistic Regression

Overall paediatric hospitalised injuries were analysed to identify the association of product-relatedness with demographic characteristics: age, gender and geographical location. For this purpose, the outcome variable of product-relatedness was limited to two categories: non-product and consumer product, excluding the possible product and other regulator groups. The possible product group was excluded as it may contain both product and non-product-related injuries that could not be confirmed due to insufficient information. The 'Other regulator' group was also excluded to focus the analysis on consumer products under the product safety regulation. Therefore, only 29002 cases grouped under the two categories were included.

After mutual adjustment for all variables included in the model, all demographic variables were significant predictors of product-relatedness. Gender difference in the number of product-related injuries appeared to be significant ($p=<0.001$) with the odds of product-related injury in males 12% higher than females (Table 5-3).

The odds of a product-related injury in major cities were almost two times higher (OR = 1.8) than remote areas (95% CI, 1.56 – 2.07). Similarly, the odds of a product-related injury in regional areas were 67% higher than remote areas (95% CI, 1.45 – 1.92). Age was associated with a decrease in the odds of product-relatedness where an increase in age was associated with 5% reduction in the odds of product-related injury.

Table 5-3 Hospital admission data: Predictors of product-relatedness

Predictors	N(%) of product-related injuries	Mean(Sd)	Odds Ratio	95% CI	Sig
Gender					
- Male	12524 (64.9%)		1.12	1.06-1.18	<0.001
- Female	6262 (64.6%)		1	Referent	
Geographic Location					<0.001
- Major cities	10075 (67%)		1.80	1.56 – 2.07	
- Regional	8287 (63%)		1.67	1.45 – 1.92	
- Remote	424 (52%)		1	Referent	
Age (0-17)		8.81 (5.3)	0.955	0.95 – 0.96	<0.001

Injury Mechanisms & Product Types

An in-depth analysis of the 18754 product-related injuries showed that involvement of products were commonly identified in eight injury mechanisms: burn, exposure to electric current and radiation, drowning, falls, poisoning, exposure to mechanical forces, threats to breathing and product-related transport accidents. The frequency of injuries with each different mechanism differs by age due to the different variations of exposure to product hazards and the development stages as shown in Figure 5-14. Younger children were more likely to be injured by falls, burns, poisoning and drowning comparative to older children. On the other hand, older children were more likely to be injured in transport accidents and exposure to mechanical forces.

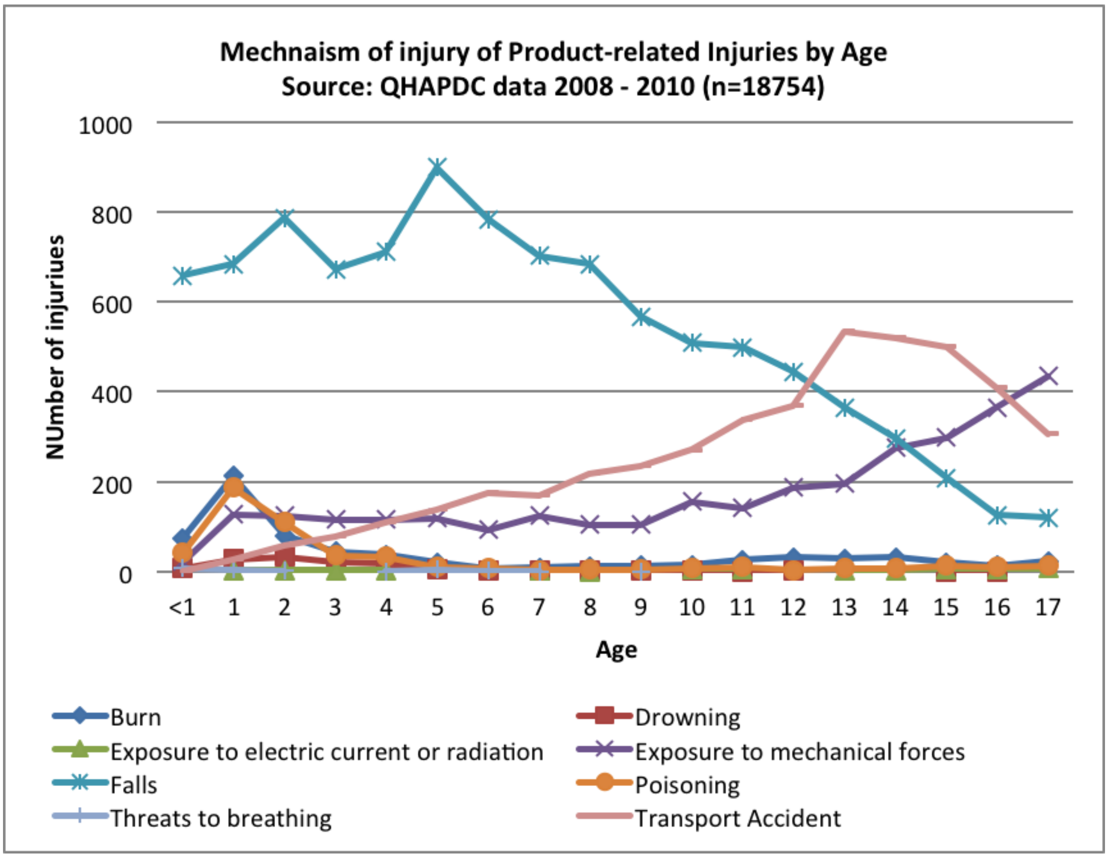


Figure 5-14 Hospital admission data: External causes of product-related injuries by age

The analysis found that falls were the most common external cause of admissions for children in 2008 – 2010 accounting for half (52%, 9721 cases) of all product-related injuries. The frequency of fall admissions reduced by the age of the children with a peak at 5 years old. The types of products causing these falls varied between different age groups. The majority of product-related falls were associated with playground equipment, furniture and pedestrian conveyances. Playground equipment falls accounted for almost half (48%, 4645 cases) of all product-related falls. Within this group, children aged 1 – 9 years old accounted for 83% (3846 cases) of all admissions related to playground equipment falls. The second most common product related to falls was furniture (27%, 2590 cases) in which younger children aged 0 – 3 accounted for 87% (2249 cases). Falls in older children aged 7 – 15 were commonly related to pedestrian conveyances such as skateboards, non-motorised scooters and roller-skates.

The second most common external cause was the product-related transport accidents which accounted for 24% (4480 cases) of all product-related injuries. The frequency of these injuries was high amongst older children aged 10 – 15. Pedal cycle accidents accounted for 68% (3056 cases) of all product-related transport injuries. Off-road motorcycles such as ag-bikes, dirt bikes and trail bikes accounted for 31% (1378) of all admissions to due to product-related transport accidents.

Table 5-4 Hospital admission data: Mechanism of injury and product types by age group

Mechanism of injury and Product Types	Age group							Total
	<1	1-3	4-6	7-9	10-12	13-15	16-17	
Falls	**658**	**2143**	**2396**	**1955**	**1454**	**870**	**245**	**9721**
Playground equipment	13	742	1742	1362	578	180	28	4645
Furniture	534	1227	488	173	100	45	23	2590
Pedestrian conveyance	111	174	166	420	776	645	194	2486
Product-related transport accidents	**2**	**169**	**425**	**627**	**981**	**1559**	**717**	**4480**
Pedal cycle		139	333	451	711	1039	383	3056
Ag-bike, dirt-bike	2	28	90	167	256	508	327	1378
Pedestrian conveyance		2	2	9	12	6	4	35
Water sport equipment					2	6	3	11
Exposure to mechanical forces	**22**	**370**	**330**	**336**	**485**	**773**	**803**	**3119**
Sharp objects	4	159	145	163	186	365	455	1477
Sport equipment	7	28	57	90	196	183	91	652
Hand tool powered/non-powered	10	99	84	67	74	131	128	593
Machinery	1	80	40	13	24	63	103	324
Jewellery		4	4	3	2	14	17	44
Household devices					3	12	8	23
Firework						5	1	6
Thermal effect	**75**	**337**	**63**	**34**	**71**	**80**	**36**	**696**
Hot household appliance	75	288	42	12	15	5	11	448
Flammable material		3	9	12	44	58	18	144
Machinery		46	12	10	12	17	7	104
Chemical effect	**42**	**338**	**53**	**16**	**22**	**28**	**24**	**523**
Chemicals	42	338	53	16	22	28	24	523
Drowning	**7**	**86**	**27**	**8**	**6**	**1**	**1**	**136**
Pool	6	82	27	8	6	1	1	131
Spa, Jacuzzi and hot tub	1	4						5
Exposure to electric current/radiation		**8**	**4**	**5**	**10**	**12**	**12**	**51**
Electrical equipment		8	4	5	10	12	12	51
Threats to breathing	**9**	**7**	**10**	**2**				**28**
Toy	2	3	3	2				10
Coin		3	6					9
Furniture	5							5
Battery	1		1					2
Plastic bag	1	1						2
Total	**815**	**3458**	**3308**	**2983**	**3029**	**3323**	**1838**	**18754**

5.4 DISCUSSION

The findings above show that proactive approach can be utilised to identify product-related injuries in ED-based injury surveillance (i.e. QISU) and in admission (i.e. QHAPDC) data. As a result of utilising the proactive approach, this study has examined the frequency of product-related injuries using broad and specific analyses. In the broad analysis, both datasets have been analysed to explore the patterns and the demographic characteristics of product-related injuries and how these differ from other injuries. In the specific analysis, both datasets have been analysed to identify the specific types of products causing injuries through different mechanisms of injury.

This section will firstly compare the findings from the different data sources and discuss the possible explanations for any similarities and differences. Secondly, this section will discuss how the frequency of product-related injuries plays a role in the prioritisation of product safety initiatives.

5.4.1 Comparisons of findings in ED-based injury surveillance and Hospital admission data

The study has found similarities and variations in the findings from the analyses of ED-based injury surveillance and hospital admission data. Demographically, there were several similarities in the pattern of injuries. Findings from both datasets showed a peak of injury frequency in children aged 1 – 3 years old. There was a slightly different finding for the second peak of injury frequency with ED-based injury surveillance paediatric injuries reaching a second peak at 10 – 12 years old whereas hospital admission data showed a second peak at 13 – 15 years old. Differences in the severity of injuries are likely to explain this variation as ED-based injury surveillance and hospital admission data are collected at different levels of care. ED-based injury surveillance data are collected from injury presentations at the emergency departments in which some injuries are treatable in the department and can be discharged without being admitted to the hospital. Hospital admission data, on the other hand, are collected from injury hospitalisations in which injuries required more than ambulatory medical treatment in the hospital. This may indicate that there were more severe injuries sustained by the 13 – 15 year old group requiring hospital admission compared to those in the 10 – 12 year old cohort.

The overall proportions of product-related injuries were similar in both datasets (ED-based injury surveillance data – 39% and hospital admission data – 32%). The breakdowns by age group also showed similar patterns of increases and decreases between both datasets with the percentage of product-related injuries being highest in infants (< 1 year old) and 4 – 6 year olds, and lowest in teenagers aged 16 – 17 years old. The percentage of product-related injuries in all age groups however was slightly higher in ED-based injury surveillance data compared to admission data. This variation may also be related to the differences in the severity of injuries in both datasets as ED-based injury surveillance and hospital admission data are collected at different levels of care. Thus, there were likely to be a number of less severe product-related injuries captured by ED-based injury surveillance data that were not captured in hospital admission data. This points to the importance of considering emergency department data for product safety surveillance as many casa may be treated and released before hospitalisation.

The in-depth analyses of both datasets found several differences related to the classification used in both datasets. The hospital admission data were classified using multiaxial external cause codes which utilise one code as an identifier for both the mechanism of injury as well as the object involved in the injury event. ED-based injury surveillance data on the other hand are classified separately for each aspect of the injury event, with objects coded using major injury factor separate from the codes for mechanism of injury. Differences were also identified in the way mechanisms of injury were grouped and terminologies used in both coding systems.

The most common mechanisms of product-related injuries in hospital admission data were falls, transport accidents and exposure to mechanical forces. Meanwhile, the main mechanisms of product-related injuries in ED-based injury surveillance data were falls, struck against object and crushing and piercing. The results seem varied as slightly different classifications were used in both datasets. However, further breakdown of the mechanism groups showed in Table 5 – 2 and Table 5 – 4 indicate similar results. Off-road transport accident was coded separately in the hospitalisation data which brought this category up in the list of common mechanisms. Conversely, in the ED-based injury surveillance data, off-road transport accidents were classified throughout the categories based on the mechanism of injury. For example, off transport accounted for 23% in falls, 10% in struck against object and 14% in crushing and piercing.

These variations in mechanism groupings complicate the comparison of findings from both data sources. Further code mapping and re-categorisation can be done to standardise the grouping and terminologies. This process was not within the scope of the current study.

Regardless of the differences in the structure of the categories used in admission and ED-based injury surveillance data, falls were found to be the most frequent cause of injuries in both datasets. The pattern of falls was also similar, with the frequency of injuries reducing by age. However, the peak of product-related falls in hospital admission data (5 years old) was older than the peak in ED-based injury surveillance data (1 year old) and there were variations in the types of product causing the falls as well.

The findings above highlight the important role of age in influencing the types of injury children are prone to and the types of product they are exposed to. A report by the US Consumer Product Safety Commission highlights the developmental stages of children’s abilities and preferences as they grow older (Therrell, Brown, Sutterby, & Thornton, 2002). Younger children are more attracted to products with bright colours and are more exposed to finished products like toys and indoor products for children, whereas older children are more exposed to outdoor activities, sport-related equipment. Instead of finished products, older children are more attracted to raw material to create new products on their own (Therrell, et al., 2002). These concepts corresponded with the findings of an Australian study conducted by Watson, Ozanne-Smith & Lough (2000) which highlighted the different types of product hazards children are exposed to, based on injury data analysis. For instance, younger children under 5 years old were more prone to fall from furniture products, children 5 – 9 years old were more likely to fall from playground equipment and older children were more likely to fall during sport activities or from bicycles (Watson, Ozanne-Smith, & Lough, 2000). In the latest study, Siskind & Scott (2013) studied the pattern of injury in children under the age of 1, and found that falls are the most prominent cause of injury reducing as age increases, while burns and foreign body injuries increased with age (Siskind & Scott, 2013). These patterns of injuries were linked to the increased mobility in children (Siskind & Scott, 2013).

5.4.2 Prioritisation of product safety issues

The proactive approach used in this study can assist in the identification of priority issues by ranking the frequency of injury caused by the different product safety issues. In the broad analysis, the study has broken down the proportion of product injuries by age, gender and geographical location. The outcome of this study is expected to assist in the prioritisation of product safety initiatives by identifying vulnerable groups. In this case, the study has found that infants (under 1 year old) and teenagers were more likely to be injured by consumer products compared to other age groups. Children in major cities were more likely to be injured than those in remote areas.

In the specific analysis, the study has identified the specific mechanisms of injury and the types of products involved in the injury events. The analysis of ED-based injury surveillance data showed a high frequency of product-related injuries relating to falls and struck and hit by object. The analysis of hospital admission data showed slightly different result with product-related falls and transport accidents in the top ranking. The outcome of this analysis will assist prioritising product safety initiatives to those types of products that commonly cause injuries. The frequency of injury as the only criteria for prioritising injuries is, however, insufficient as product safety regulators are also looking at the severity of injury and the causality of injuries.

5.5 CONCLUSION

This chapter has shown that proactive approach can be utilised to identify product-related injuries in ED-based injury surveillance (i.e. QISU) data and in admission (i.e. QHAPDC) data. As a result of utilising the proactive approach, this study has examined the frequency of product-related injuries to prioritise product safety initiatives to those mechanisms of injury that cause the highest frequency of product-related injuries. The results from ED-based injury surveillance data analysis showed high frequency of product-related injuries related to falls, struck and hit by object and crushing or piercing. The results from hospital admission data analysis showed high frequency of product-related injuries related to falls, product-related transport accidents and exposure to mechanical forces.

Chapter 6: Severity of product-related injuries

Chapter 6: Severity of product-related injuries

6.1 INTRODUCTION

Methods to measure injury severity have been developed in a variety of settings for different purposes. In the healthcare setting, severity of injury is considered for many purposes such as the triage process, patient monitoring, clinical management, prognosis assessment, evaluation of health services, research studies and more (McEvoy & Walker, 2004). In the product safety system, severity of injury is an essential aspect in the risk assessment process which assists in the determination of the consequences of being injured by a hazardous product/s.

Severity scoring systems have been developed in both the product safety system and the injury surveillance system to serve injury prevention and product safety purposes. In healthcare settings, severity of injury can be measured in a number of ways. Several classification systems such as the Abbreviated Injury Scale (AIS), Injury Severity Scoring (ISS) and the International Classification of Diseases Injury Severity Score (ICISS) have been extensively used to describe injury severity. These severity scoring systems are constructed by multifaceted coding processes and/or statistical calculations. In this study, the AIS was not used in the severity analysis as it requires a complex coding process which can be challenging and beyond the scope of feasibility for use by product safety regulators.

There are also simpler ways of measuring injury severity by assessing the outcome of injury (admission or death rate), the urgency of injury to be treated (Triage score), and the length of time required to treat the injury (length of stay).

In the product safety setting, different classification systems are used to determine the severity of injury caused by products in a risk assessment process. Several classification systems have been adopted in the Australian product safety system. Previously a system adopted from New Zealand had been used to perform risk assessment in which injury severity is measured and classified (Benis, 1990). The current risk assessment process used by Australian product safety regulators is adopted from the European Commission. This risk assessment process is called

RAPEX, a Rapid Alert system to allow Rapid Exchange of information in Europe on measures taken to prevent or restrict the marketing or use of products posing a serious risk to the health and safety of consumers. Excluded from RAPEX are foods, pharmaceuticals and medical devices, which are covered by other mechanisms (European Commission, 2010). This was described in more detail in chapter 2.

The studies presented in this chapter describe the severity of product-related injuries using hospitalisation-based severity ratings, ED-based injury surveillance-based severity ratings and a product safety-based severity rating. The following research questions (RQ) are addressed in this chapter:

> **RQ 6.1**: What are the mechanisms of product-related injury that result in the most severe injury presenting to emergency departments? (Study II)
>
> **RQ 6.2**: What are the mechanisms of product-related injury that result in the most severe injuries admitted to hospital? (Study III)
>
> **RQ 6.3:** Can a product safety-based severity scoring system be applied to injury data? (Study II & III)

6.2 METHOD

6.2.1 Case selection and data fields

A secondary analysis of paediatric injury data was performed using cases from the QISU and from the QHAPDC collected between 1 January 2008 and 31 December 2010. Data obtained from both databases were filtered based on the intention of injury, eliminating assaults, self-harm and unintentional injury. However, all injury cases among children under the age of 12 years old coded under self-harm were still included as previous research suggests that the onset of deliberate self-harm starts at the age 12 (Roberts, Li, & Barker, 1998; Sourander et al., 2006). The data fields to examine injury severity in QHAPDC data were length of stay, separation, and injury diagnoses. The data fields to examine injury severity in QISU data were Triage score, mode of separation and ICD diagnosis. Other data fields such as age, gender, postcode of usual residence and mechanism of injury in both datasets were also included in the analysis to examine demographic differences.

6.2.2 Procedure

Severity of product-related injuries in QISU and QHAPDC data was examined in three phases. Phase 1 involved the analysis of injury surveillance severity measures, phase 2 involved hospitalisation-based severity measures and the third phase involved a product safety-based severity ranking. The last phase was conducted to prioritise mechanisms of injury based on the combination of severity measures.

Phase 1 – Injury surveillance-based severity measures

The aim of phase 1 was to undertake an analysis of data to address the research question of **what are the mechanisms of product-related injury that result in the most severe injury in ED-based injury surveillance (QISU) data?** In addressing the research question, Phase 1 involved analysis of three injury surveillance-based severity measures: Triage score, mode of separation (MOS) and the Survival Risk Ratio (SRR). The Triage score and MOS analyses are simple, utilising readily available variables in QISU data. The SRR on the other hand is a more complex severity rating that involves recoding and calculations based on a single ICD diagnosis code in QISU data. All mechanisms of injury were assessed based on these three severity measures and ranked based on the number of serious injuries. In conjunction with the severity measures, demographic differences in age, gender and geographical locations were also explored in this phase. The procedures for the severity analysis are explained below:

Triage score

The triage score is a tool used in emergency departments to prioritise service based on the level of urgency of a patient's condition. The triage category is assessed at the time a patient initially presents at the ED and the severity of the condition may change or be re-evaluated after treatment. Some injuries require immediate action but are easily treatable in the ED and some require extended treatment necessitating hospital admission or transfer to another department. The triage score can be used to roughly indicate the severity of injury when the injured patient presents at the ED. Triage categories are scaled from Category 1 "resuscitation" (most severe) to 5 "non-urgent" (least severe) (FitzGerald, et al., 2010).

In this study, severity of injury was measured based on the proportions in each triage category. Severe injuries were considered to be those in triage category 1, requiring resuscitation (immediate) or triage category 2, emergency treatment within 10 minutes; medium severity were those injuries in category 3, requiring urgent treatment within 30 minutes and low severity for those injuries in triage category 4, requiring semi urgent (60 minutes) and non-urgent (120 minutes) treatment, triage category 5.

Mode of separation

Status at discharge is recorded in QISU data, and is classified into 7 categories of separation modes: 1 - Admitted (Excluding ED bed), 2 – Discharged, 3 – Transfer to another hospital, 4 – Did not wait, 5 – Left after treatment commenced, 6 – Died in ED and 7 – Dead on arrival. In this study, severity of injury was measured based on the proportion of patients in each of the mode of separation categories. Severe injuries were considered to be those resulting in hospital admissions (1 and 3) or deaths (6 and 7). A binary variable was created which categorised cases into severe (1, 3, 6, 7) or non-severe (2, 4, 5).

SRR

The International Classification of Disease Injury Severity Score (ICISS) is derived from the Survival Risk Ratio (SRR). SRR is defined by Stephenson (2003) as the ratio that represents the likelihood that a patient will survive a particular injury. SRR and ICISS are valued between 0 to 1 with 0 indicating a 0% survival rate and 1 indicating a 100% survival rate. The application of ICISS scores in injury data involves assigning an SRR for each ICD injury diagnosis code to determine the probability of survival for each individual injury diagnosis code. The SRR expresses the ratio of patients within an ICD injury diagnosis code who have not died relative to the total number of patients diagnosed within the same code.

QISU data contains a single principal diagnosis code for each patient, coded using ICD-10-AM. This principal diagnosis is the primary condition accountable for causing the attendance of the patient at the emergency departments. The ICD codes can be used to determine severity using the SRR from the ICISS method. As QISU data only have one ICD code, there is no multiplicative calculation able to be conducted for this dataset. As a result, the SRR for a single ICD injury code is only able to be used as a proxy indicator of severity.

Previous work by Stephenson et al (2003) at the National Injury Surveillance Unit (NISU) generated a list of SRR's for each ICD injury code which was obtained and applied for the purposes of this study (Stephenson, et al., 2003). This list was assigned to QISU data to give each injury an SRR and this assignment was used to calculate the mean SRR in each age group, mechanism of injury and product type. Severity ranking was performed by ranking SRRs in ascending order from the lowest mean survival ratio to the highest mean survival ratio.

However, it must be acknowledged that there are reliability issues revolving around SRRs associated with single diagnoses. SRRs have only previously been used to create ICISS scores for hospital admission data where co-morbid conditions are also coded. Using SRRs for emergency department data where only single diagnosis data are available has some limitations. A single SRR is not valid as a severity indicator for ED cases as it is designed only for admitted cases, and therein has been used only as one of several proxy indicators of severity in this study. Using SRRs in isolation is not as reliable as the full ICISS scoring based on the complete range of ICD diagnosis codes. However, the SRR severity measure is the only available injury-based severity measure applicable for ED injury data, even though it only details the principal diagnosis and not comorbid diagnoses.

Phase 2 – Hospitalisation-based severity measures

The aim of Phase 2 was to undertake an analysis of data to address the research question of **what are the mechanisms of product-related injury that result in the most severe injury in QHAPDC data?** In addressing the research question, Phase 2 involved analysis of three hospitalisation-based severity measures: length of stay (LOS), mode of separation (MOS) and the International Classification of Disease-based Injury Severity Score (ICISS). The LOS and MOS analysis are simple, utilising readily available variables in QHAPDC data. The ICISS on the other hand is a more complex severity rating that involves recoding and calculation processes based on a set of ICD diagnosis codes in QHAPDC data. All mechanisms of injury were assessed based on these three severity measures and ranked based on the number of serious injuries. In conjunction with the severity measures, demographic differences in age, gender and geographical locations were also explored in this phase. The procedures involved in the severity analysis are explained below:

Length of stay

The length of stay of an episode of care is the total of all the patient days accumulated during a particular episode. In hospital admission data, the length of stay is captured as the number of days in which a patient occupies a bed for at least one day in a hospital ward, excluding an emergency department bed.

In this study, length of stay was used to assess the severity of product-related injuries based on the number of days that the patient stayed in the hospital to treat the injury. This was conducted by calculating the Average Length of Stay (ALOS) of patients who sustained product-related injuries based on several factors such as age, mechanisms of injury and types of products. ALOS is computed by dividing the total number of in-patient hospital days in all hospitals (counted from the date of admission to the date of discharge) by the total number of discharges, including deaths. Any fatality cases were excluded from the calculation of ALOS to reduce bias.

The length of stay data is skewed given the majority of cases stay only one day in the hospital. While the median length of stay can be used to represent the different level of severity, the average length of stay was considered more appropriate to be used in this study to capture the high-end tail. This is to account for the worst-case scenario of the injury consequence in order to align with the product safety approach in the risk estimation process (Productivity Commission, 2006).

Mode of separation

Mode of separation is the status at discharge after a certain period of treatment for an injury in a hospital. QHAPDC data includes 7 groups of separation modes including; 1 - Home or usual residence, 2 - Other health care establishment, 3 - Died in the hospital, 4 - Episode change, 5 - Residential aged care service, 6 - Transferred to another hospital and 7 - Other. In this study, severity of injury was measured based on the proportion of mode of separations. These modes of separation were classified into three levels to reflect the severity of injury based on the outcome of hospital admission. Least severe was used for those cases discharged to home or usual residence (1), medium severity was assigned to those cases discharged to other health care services (2, 4, 5, 6) and Most severe was assigned for those cases who died in hospital (3).

ICISS

A more complex severity measure was also applied to QHAPDC data using the ICISS method as previously described in Phase 1. The ICISS score is derived from the SRR which is the ratio that represents the likelihood that a patient will survive a particular injury. The ICISS score is not available as a data field in the QHAPDC dataset and must be calculated based on ICD diagnosis codes.

The application of ICISS in QHAPDC data involves assigning an SRR for each ICD injury diagnosis code to determine the probability of survival for each individual injury diagnosis code. In this context, the SRR represents the patients within a given injury code who survived, relative to those who did not. As previous, the same list of SRRs obtained from the NISU was used for this study.

Each injury case in QHAPDC data has a set of ICD injury diagnosis codes to represent all injuries sustained by the patient. An SRR was assigned to each code giving each injury case more than one SRR. Thus, in order to obtain an ICISS score for each case, the ICISS score was calculated using a multiplicative method by multiplying all SRR's for each patient.

The outcome of this calculation was used to describe the severity of injury in different age groups and for different external causes. The mean of all ICISS scores for each mechanism was calculated and ranked from the least to the highest mean. The minimum ICISS was also considered to take into account the worst possible injury.

Phase 3 – Product safety-based severity measures

The aim of Phase 3 was to undertake an analysis of data to address the research question of **can a product safety-based severity scoring system be applied to injury data?** As noted previously, the RAPEX severity rating system was used for this analysis. In order to assign the RAPEX severity ratings in injury data, Phase 3 involved code mapping which followed several steps. The assignment of the RAPEX severity rating is based on injury hazards which are coded using ICD-10-AM in injury data. Hence, the first step to map ICD codes to RAPEX was to extract the injury types. ICD-10-AM codes are largely structured based on body region, however injury types can also be extracted from the third character of the code.

These injury types were then matched to the injury type outlined in the RAPEX guide. Once mapped, ICD codes were allocated into RAPEX severity levels.

There are 4 levels of severity ratings under RAPEX. In order to differentiate between these 4 levels of severity, the RAPEX guide for severity of injury was used. The guide consists of 24 injury types and provides examples of injury conditions at all four levels based on the type of injury. A list of ICD codes mapped into RAPEX ratings in all hazard types is presented in the Appendix 8. The compatibility of the RAPEX ratings and ICD injury codes varies across each hazard type. Some RAPEX hazards are well aligned with ICD codes and some are differently structured and as a result, ICD injury codes were only able to be mapped for certain hazard types (see Appendix 8). Burn cases in QISU and QHAPDC data were selected to be classified using RAPEX severity ratings due to the compatibility of the RAPEX burn classification and ICD burn codes as a demonstration of the use of RAPEX principles on injury data.

In this study, the RAPEX rating was specifically applied to ICD-coded burn cases in QHAPDC and QISU data. The analysis was not able to be conducted to apply the RAPEX severity rating to all product-related injuries as it was beyond the scope of the research. This study was only aimed at assessing the feasibility of using the RAPEX system in injury data.

The RAPEX system focuses on burn thickness and the percentage of Body Surface Area (BSA). The RAPEX classification for burn cases based on the RAPEX guideline is as follow:

Table 6-1 RAPEX Severity Ratings for Burns

RAPEX Injury Severity	**RAPEX Laceration**
1	First degree, up to 100 % of body surface, Second degree, < 6 % of body surface
2	Second degree, 6-15 % of body surface
3	Second degree, 16-35 % of body surface, or 3o, up to 35 % of body surface, Inhalation burn
4	Second degree or Third degree, > 35 % of body surface, Inhalation burn requiring respiratory assistance

The application of RAPEX ratings in QISU data is slightly different to QHAPDC data due to the differences in the dataset structures. For application in the QISU data, only burn thickness was used to classify cases into RAPEX ratings, as QISU data only contain one ICD diagnosis code for each injury case which only indicates the burn thickness. Admission status was also used to assist in the process of differentiating BSA for RAPEX ratings. In Queensland emergency department settings, admission is granted for burn cases in which BSA is more than 10%. Therefore partial burns thickness cases with admission to hospital after ED treatment were coded under higher RAPEX ratings (3 or 4).

The QHAPDC data contains a set of ICD codes that capture burn thickness (T20-T30) as well as an additional code from T31 range to indicate the burn surface area. Medical procedures performed while the patient was admitted in the hospital are also captured in the QHAPDC data in coded format. The application of RAPEX ratings in QHAPDC burn data incorporating these three factors follows step by step process as illustrated in Figure 6-1.

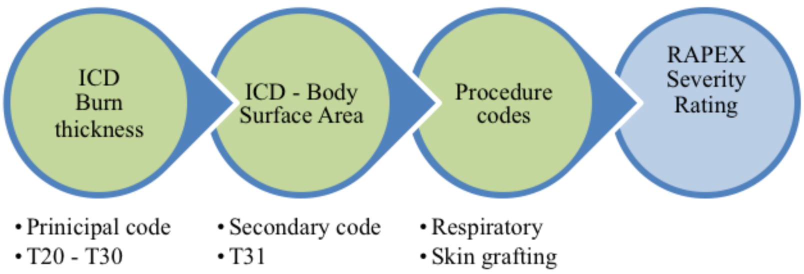


Figure 6-1 RAPEX mapping process in hospital admission data

A mapping matrix tool was used in the application of RAPEX severity ratings in the QHAPDC burn data (Table 6-2). The table incorporates burn thickness and BSA. In addition to these two factors, presence of respiratory assistance and/or skin grafting was also considered in the RAPEX rating application as these procedures can be indications of high severity injury. Therefore, cases with these procedures were coded under higher RAPEX ratings (3 or 4).

Table 6-2 RAPEX Burn Mapping Matrix for hospital admission data

		Principal code	**A** **Unspecified** T20.0, T21.0, T22.0, T23.0, T24.0 T25.0, T29.0, T30.0	**B** **Erythema** T20.1, T21.1, T22.1, T23.1, T24.1 T25.1, T29.1, T30.1	**C** **Partial** T20.2, T21.2, T22.2, T23.2, T24.2 T25.2, T29.2, T30.2	**D** **Full** T20.3, T21.3, T22.3, T23.3, T24.3 T25.3, T29.3, T30.3
Secondary code		3rd Ch / 3rd Ch	0	1	2	3
1	T31.0 BSA Less than 10% or unspecified	0	Unclassifiable	Burn 1	Burn 1 Burn 2	Burn 3
2	T31.1 BSA 10-19%	1	Unclassifiable	Burn 1	Burn 2 Burn 3	Burn 3
3	T31.2 BSA 20-19%	2	Unclassifiable	Burn 1	Burn 3	Burn 3
4	T31.3 BSA 30-39%	3	Unclassifiable	Burn 1	Burn 3 Burn 4	Burn 3 Burn 4
5	T31.4 BSA 40-49%	4	Unclassifiable	Burn 1	Burn 4	Burn 4
6	T31.5 BSA 50-59%	5	Unclassifiable	Burn 1	Burn 4	Burn 4
7	T31.6 BSA 60-69%	6	Unclassifiable	Burn 1	Burn 4	Burn 4
8	T31.7 BSA 70-79%	7	Unclassifiable	Burn 1	Burn 4	Burn 4
9	T31.8 BSA 80-89%	8	Unclassifiable	Burn 1	Burn 4	Burn 4
10	T31.9 BSA 90% or more	9	Unclassifiable	Burn 1	Burn 4	Burn 4

T26 Eye Injury
T27 Respiratory Tract → without 13882-00 - 13882-02 **Burn 3** or with 13882-00 - 13882-02 **Burn 4**
T28 Internal organ

A range of burn codes with the third character '0' are unclassifiable as '0' indicates unspecified burn thickness. Furthermore, several codes could not be exclusively mapped to RAPEX severity ratings due to the BSA range difference in RAPEX severity ratings and ICD-10-AM. Therefore, when the severity ratings were applied to QHAPDC burn data, several burn cases matching the descriptions in cells C1, C2, C4 and D4 (see Table 6-2) are double rated under the RAPEX severity ratings.

In the product safety system, a rule of thumb applies in which products where injuries or potential injuries are classified as severity level 3 and 4 are regarded as high risk (European Commission, 2010). Therefore, in this study, QISU and

QHAPDC data were divided into two groups ‘Below severity threshold’ (level 1 and 2) and ‘Above severity threshold’ (level 3 and 4) based on the RAPEX severity level.

Phase 4 – Prioritisation of injuries based on severity measures

In the final phase, prioritisation of injury mechanisms was undertaken based on the combined results of all severity measures. This was conducted by ranking all the mechanisms of injury based on the severity analyses. In QISU data, results from all injury surveillance-based severity measures including triage scoring, mode of separation and SRRs were used to prioritise the mechanism of injury that produced the most severe injuries. In the analysis of triage scoring, the proportions of high severity injuries, which included triage category 1 (resuscitation) and category 2 (emergency), for each mechanism of injury was quantified and ranked from the highest proportion to the lowest. Similarly, in the analysis of mode of separation, the proportions of high severity injuries, which included the death, admission and transfer to another hospital cases, for each mechanism of injury, was quantified and ranked from the highest proportion to the lowest. In the SRR analysis, the mean SRR for each mechanism of injury was calculated and ranked from the lowest mean SRR to the highest SRR. In order to obtain the overall severity ranking, all mechanisms of injury were tabulated and mean severity rankings were calculated based on the rankings in the three severity measures. All mechanisms of injury were then ranked based on the mean severity from the lowest to the highest.

A similar process was conducted with the QHAPDC data, combining results from all analyses of length of stay, discharge status and ICISS score in the prioritisation table. Mechanisms of injuries were ranked based on the ALOS from the highest to the lowest. Mean severity was calculated based on the severity ranking in each hospitalisation-based severity measure. All mechanisms of injury were then ranked based on the mean severity, from the lowest to highest. These results were then combined with frequency and causality rankings and are reported in chapter 8.

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6.3 RESULTS

6.3.1 Severity of product-related injuries in ED-based injury surveillance data

Triage Score

An analysis of 75,947 unintentional paediatric injuries in ED-based injury surveillance data was conducted to describe severity based on the triage scoring. Triage scoring is used in emergency departments to determine the urgency of treatment required for the injuries at the point of a patient's arrival at the emergency department. Overall, the results of the analysis showed 6.5% of injury cases were classified as high severity based on the urgency of treatment required for these injuries (Triage 1 - Resuscitation or Triage 2 - within 10 minutes). Approximately 26% required urgent treatment within 30 minutes (medium severity) and 67% requiring semi urgent or non-urgent ED treatment (Triage 4 and 5 – low severity) ($\chi^2 = 459.718$, $p < 0.001$).

The proportion of high severity injuries (Triage 1 and 2) were shown to be the highest amongst infants under 1 year old (8%) and the lowest proportion amongst older children age 16-17 (3.75%). The proportion of high severity injuries was also high in children aged 10-12 years, accounting for 7%. A similar pattern was also found for the proportion of medium severity injuries in which the highest proportion was found amongst the infants under 12 months (38%) and the lowest amongst the 10-12 year olds (23%).

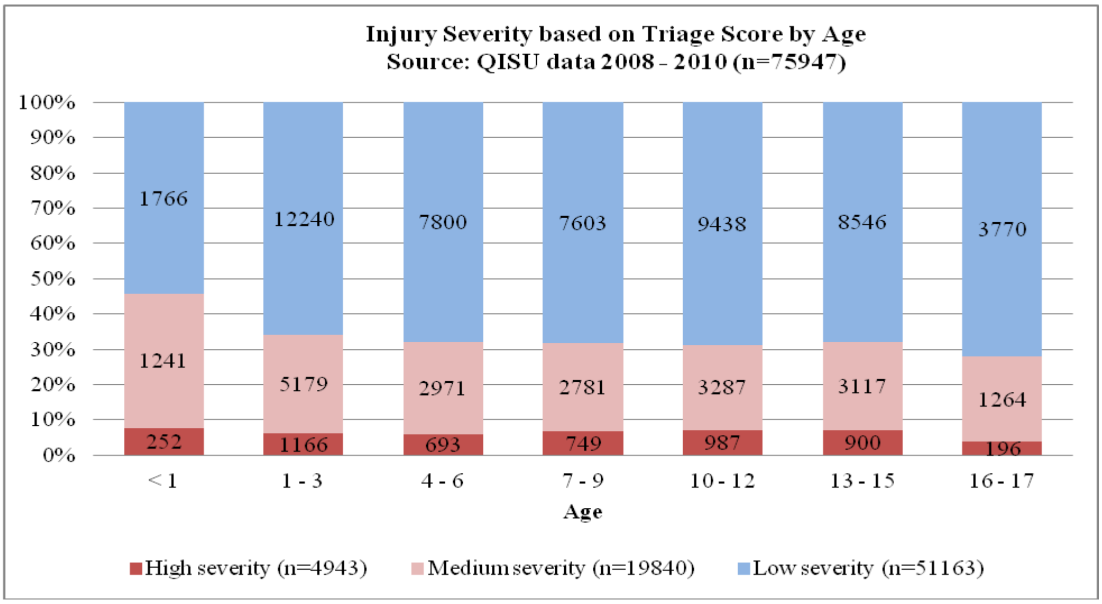


Figure 6-2 ED-based injury surveillance data – Triage Severity Groups by Age groups

An analysis of triage categories based on product-relatedness showed that injuries from other regulators' products had the highest proportion of high severity injuries (Triage 1 and 2) with 13% of all injuries under this category requiring resuscitation or treatment within 10 minutes (χ^2 = 1056.66, $p < 0.001$). Non-product injuries had the second highest proportion of high severity injuries (7%), followed by consumer product injuries (5%). Similar patterns were also found in the proportion of medium severity injuries in which injuries by other regulated products had the highest proportion (30%), followed by non-product injuries (26.3%) and product injuries (25.9%).

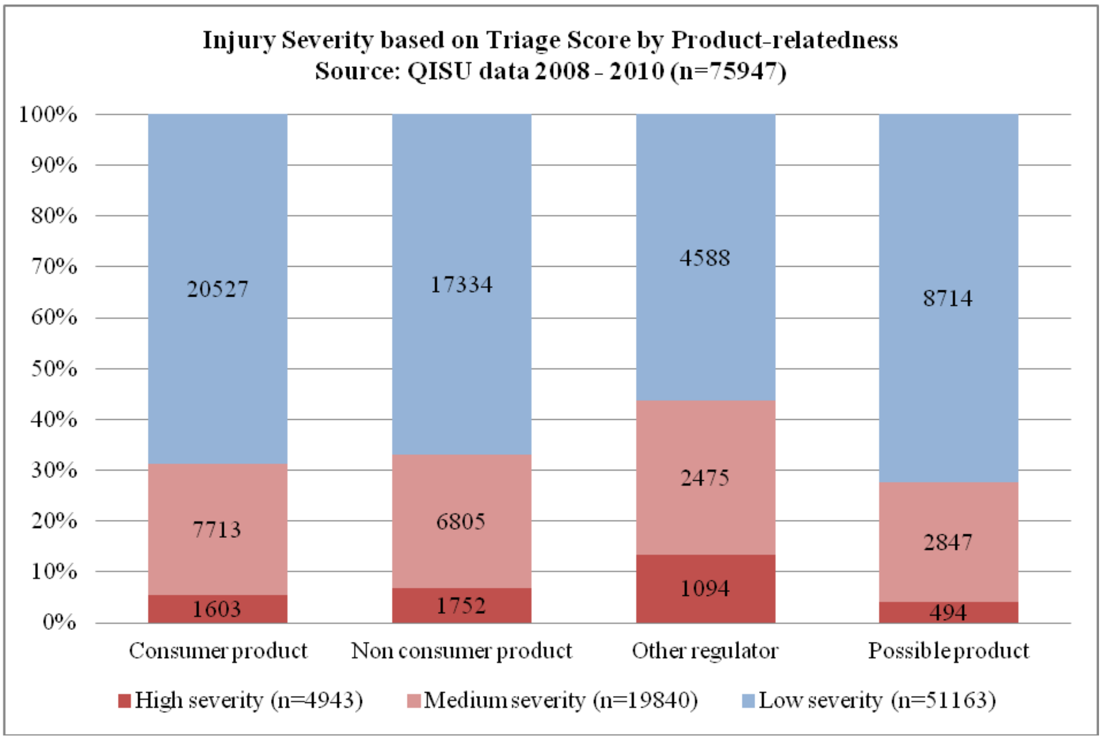
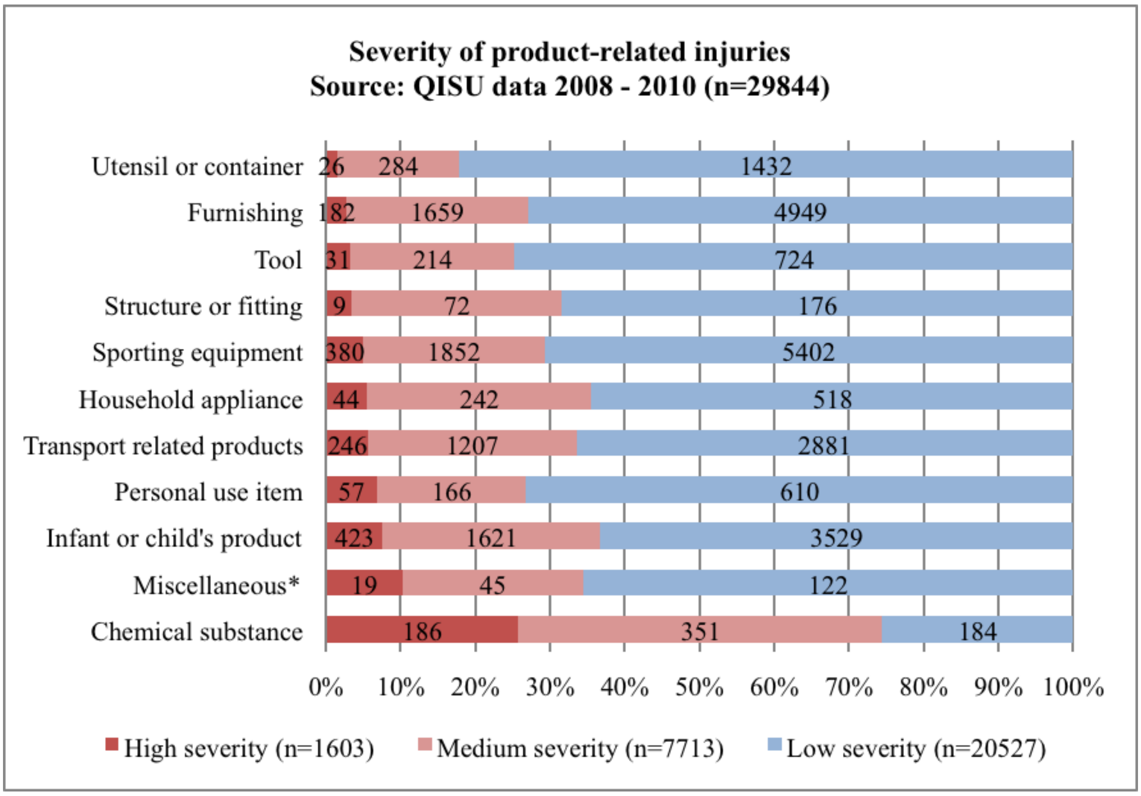


Figure 6-3 ED-based injury surveillance data – Triage Severity Groups by Product-relatedness

In depth analysis of product-related injuries was conducted to describe the severity based on triage categories in each product group. Figure 6-4 shows that chemical substances had the highest proportion of high severity injuries, with approximately 26% of children presenting with chemical substance injuries requiring resuscitation or treatment in less than 10 minutes (χ^2 = 3470.62, $p < 0.001$). The proportion of high severity injuries in other product groups was less than 10%. Serious injuries due to chemical substances are mostly associated with the ingestion of household chemicals.



*Miscellaneous includes materials such as ropes, strings, pin, needles, fireworks etc

Figure 6-4 ED-based injury surveillance data – Triage Severity Groups by Major Injury Factor Groups

Severity categories were tabulated based on the mechanism of injury code groups to describe product-related injury severity by different injury mechanisms. As shown in Figure 6-5, injuries due to chemical effects had the highest proportion of high severity injuries (Triage 1 and 2) with approximately 28% of injuries under this mechanism requiring resuscitation or ED treatment within 10 minutes ($\chi^2 = 3678.1$, $p < 0.001$). The second highest group to receive a triage 1 or 2 was suffocation, with 18% of injuries due to suffocation classified as high severity. This was followed by injuries due to electricity and radiation, in which 12% of all product-related thermal effect injuries were triaged 1 or 2. Similar patterns were found in the proportion of medium severity injuries with chemical effects having the highest proportion of cases (50%), followed by exposure to electricity or radiation injuries (48%) and thermal effect injuries (35%).

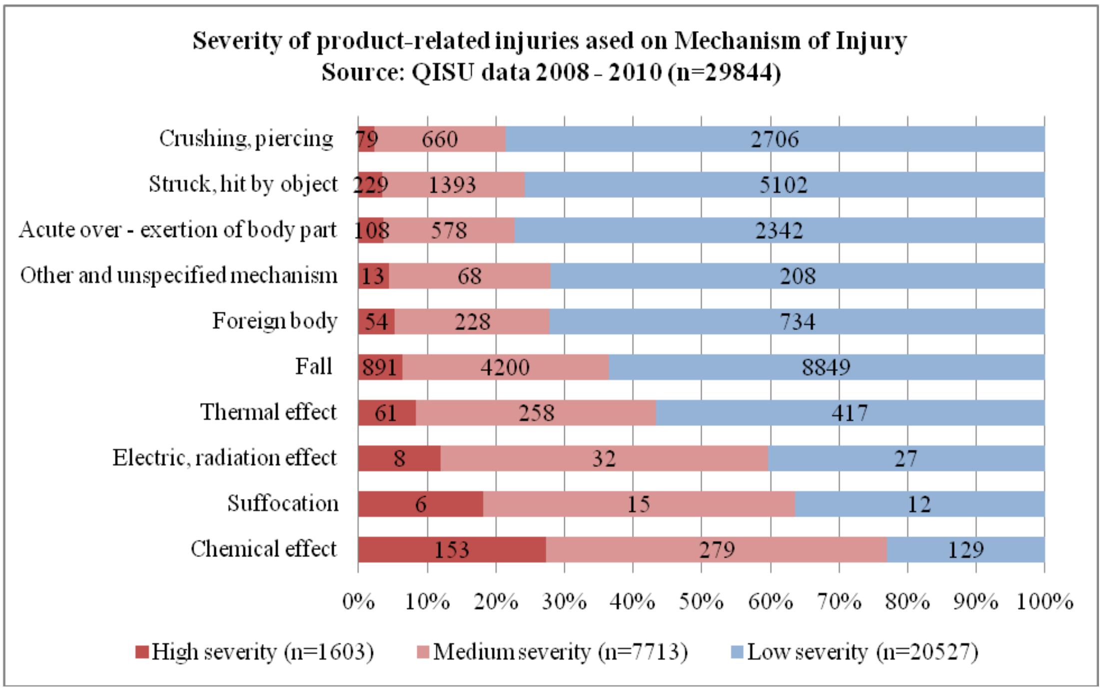
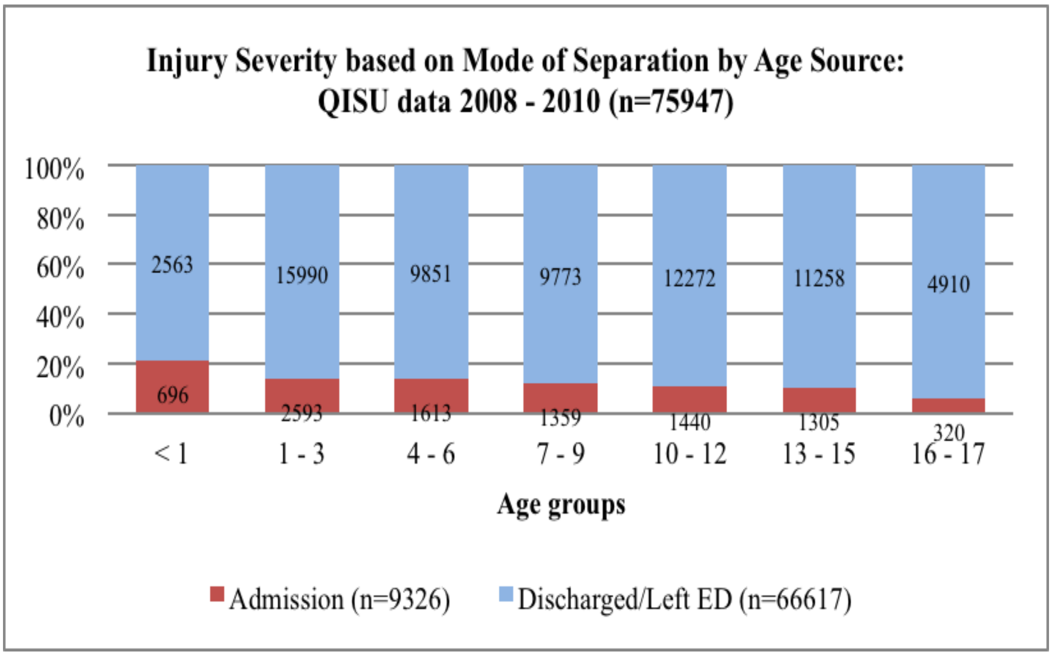


Figure 6-5 ED-based injury surveillance data – Triage Severity Groups by Mechanism of injury

Mode of separation

Severity was also analysed based on the outcome of treatment in the ED by looking at the modes of separation. Overall, approximately 88% of all unintentional injury admissions to ED were discharged or left ED during or before ED treatment. Approximately 12% were admitted to hospital after ED treatment. There were 4 deaths in the ED reported in ED-based injury surveillance data.

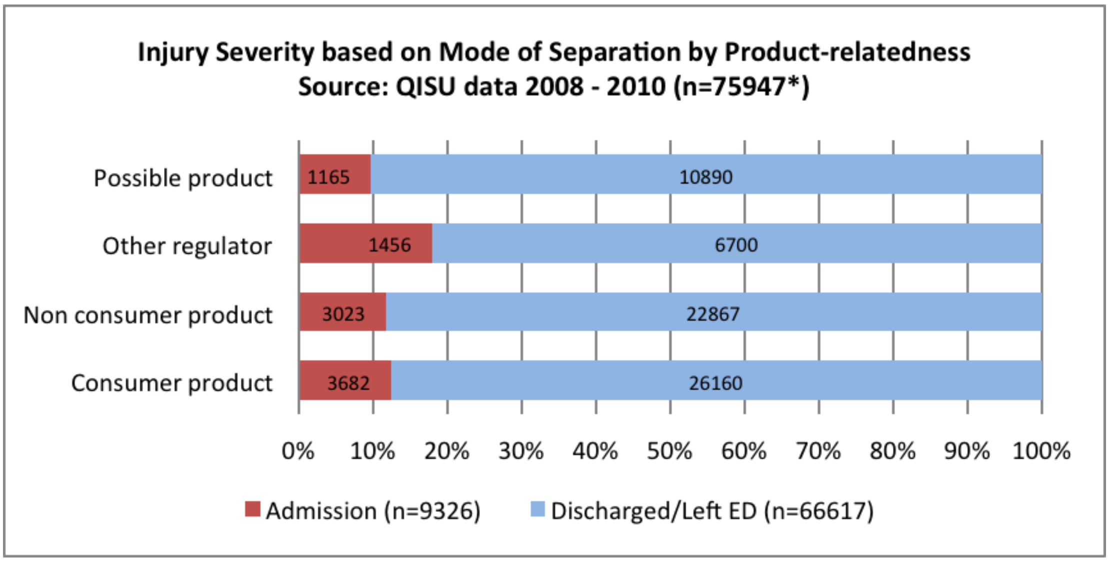
As shown in Figure 6-6, the proportion of hospital admissions after ED treatment was found to reduce by age, with the highest in infants under 1 year old with 21% of injuries within this age group being admitted or transferred to another hospital. The lowest proportion of admissions was found in the oldest age group (16-17 years old), accounting for 6%. The ages of the four reported deaths were 2, 3 6 and 7 years old.



*4 cases of death were identified in children aged age 2, 3 6 and 7 years

Figure 6-6 ED-based injury surveillance data – Mode of separations groups by Age

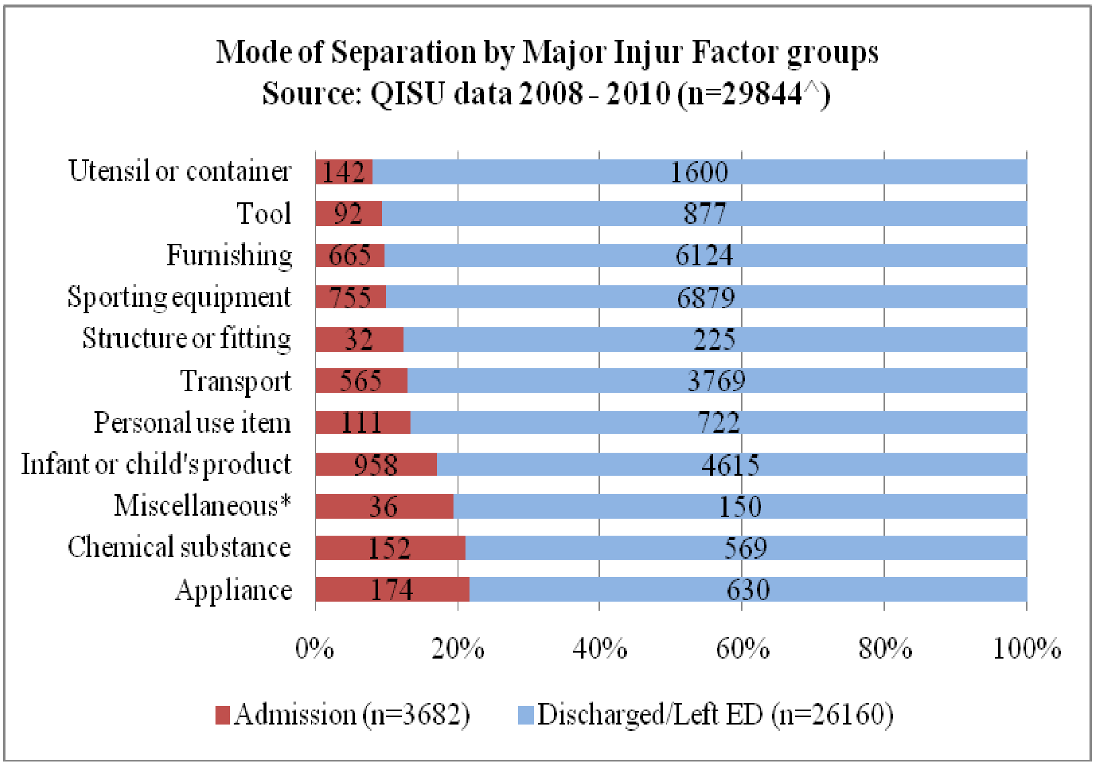
Further analysis on mode of separation based on product-relatedness was conducted. The result shows that two of the four reported deaths were related to consumer products. As shown in Figure 6-7, the proportion of hospital admissions was the highest in injuries by other regulator products with 18% of injuries under this category being admitted or transferred to hospital after ED treatment. This was followed by consumer product injuries with a 12.3% admission rate, and non-product injuries with 11.7% admission rate.



*4 cases of death were identified including two in the product-related group

Figure 6-7 ED-based injury surveillance data – Modes of separation groups by Product-relatedness

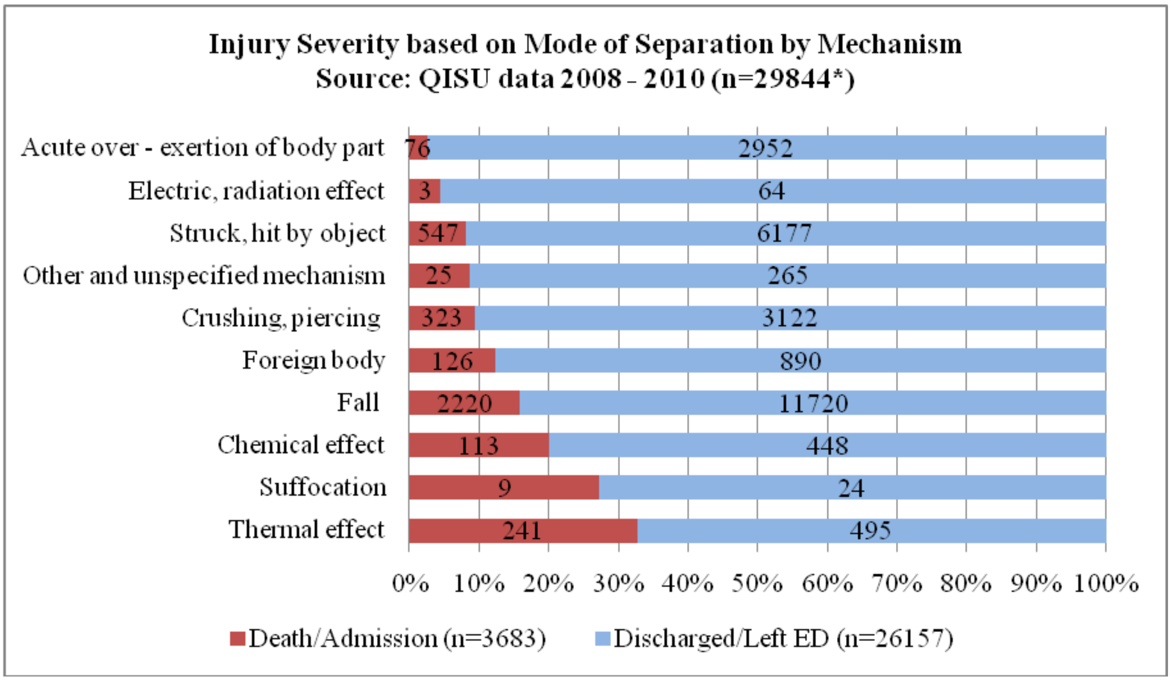
The analysis of three years of ED-based injury surveillance paediatric data shows that injuries due to appliances had the highest admission rate amongst other product groups, accounting for 22% of cases of hospital admission. The frequent admissions to hospital in the appliances group were related to the nature of injury associated with this product group. Appliances often cause burns and electrocution to the injured person and these require extended treatment and therefore warrant an admission to hospital. This group was followed by chemical substances (21%) and the miscellaneous product group (19%), in which products like ropes, strings, pin, needles, fireworks etc. were coded.



*Miscellaneous includes materials such as ropes, strings, pin, needles, fireworks etc
^2 cases of product-related death were identified

Figure 6-8 ED-based injury surveillance data – Mode of separations groups by Major Injury factor Groups

In-depth analysis of modes of separation based on mechanism of injury showed that product-related injuries due to thermal effects had the highest proportion of hospital admissions, with 33% of injuries with this mechanism being admitted or transferred to another hospital. This was followed by injuries due to suffocation, with an admission rate of 27% and injuries due to chemical effects, with an admission rate of 20%. One product-related death was caused by a fall from furnishing and another death was caused by being struck or hit by a car while riding a bicycle.



*Four injury cases relating to a biohazard were excluded

Figure 6-9 ED-based injury surveillance data – Mode of separations groups by Mechanism of Injury

SRR

Severity of injury was analysed using the Survival Risk Ratio (SRR) list which was obtained from the National ED-based injury surveillance Unit and assigned to ED-based injury surveillance data. The severity of injury increases as the value of SRR decreases as an SRR of 1 means 100% survival rate. Overall, an average SRR of 0.992 was calculated across all ED-based injury surveillance unintentional children's injuries. As shown in Figure 6-10, SRR appears to increase by age with the lowest mean SRR amongst the younger children, especially infants under 1 year old, with a mean SRR of 0.982. The highest mean SRR was found amongst older children aged 10-12 years old and 16-17 years old, with mean SRR of 0.993.

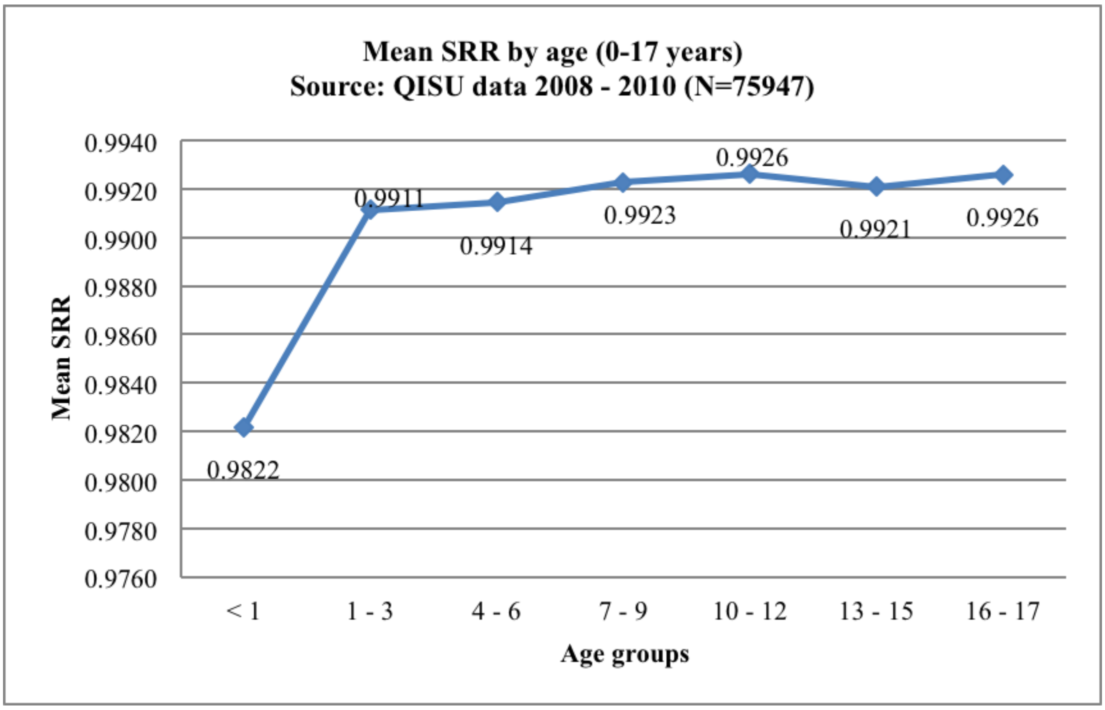


Figure 6-10 ED-based injury surveillance data – Mean SRR by Age

Further analysis of SRR on product-relatedness groups showed a variety of patterns across age groups. Overall, injuries from other regulator products had the lowest mean SRR of 0.988. This was followed by product-related injuries (Mean SRR = 0.991), non-product injuries (Mean SRR = 0.991) and the highest mean SRR of 0.992 in possible product injuries. As shown in the Figure 6-11, mean SRR in all product flag groups of injuries appeared to improve by age, as indicated by an increase in mean SRR. Compared to other age groups, injuries from other regulator products had the lowest mean SRR in infants under 1 year old, with a mean SRR of 0.978. Similarly, injuries amongst consumer products had the lowest mean SRR of 0.982 in this age group (<1 year old) when compared with mean SRR in other age groups.

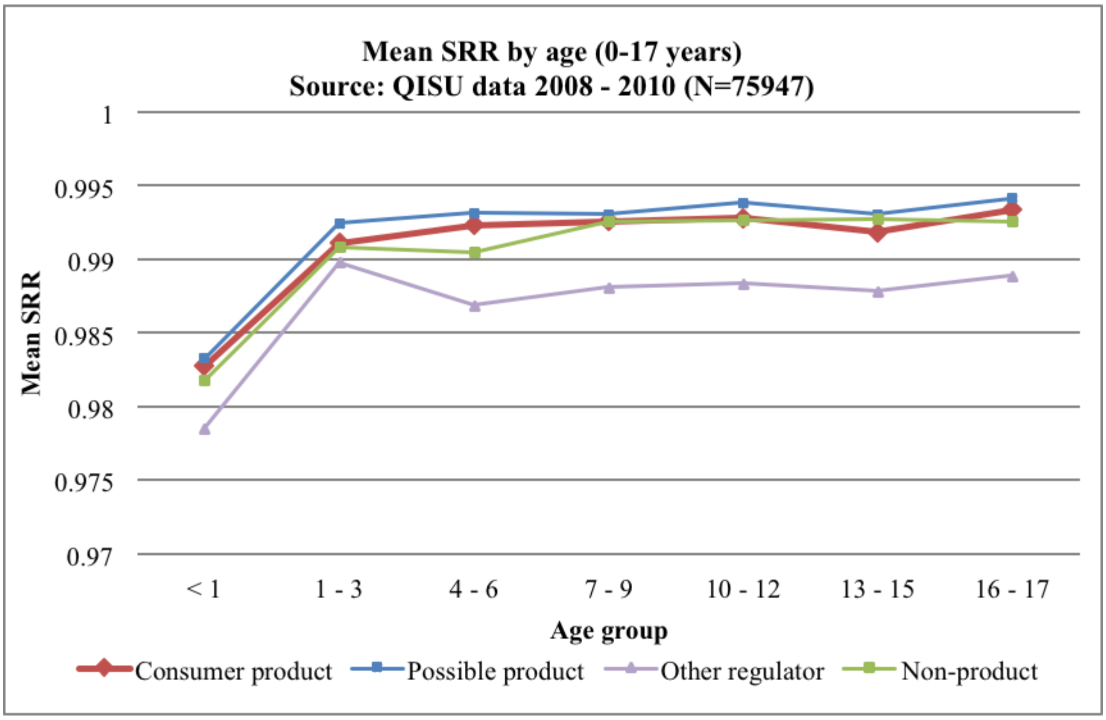


Figure 6-11 ED-based injury surveillance data – Mean SRR by Product-relatedness

An in-depth analysis of SRR was conducted on product-related injuries based on the Major Injury Factor (MIF) codes to identify product types. The result showed chemical substances, personal use items and appliances were on top of the severity ranking based on the lowest minimum SRR of 0.545. This suggests that these products are more likely to cause a fatal outcome than other product groups.

Table 6-3 ED-based injury surveillance data – Mean SRR by Major Injury Factor Groups & Age groups

Major Injury Factor group	**Age groups Minimum and Mean SRR**															
	< 1		**1 - 3**		**4 - 6**		**7 - 9**		**10 - 12**		**13 - 15**		**16 - 17**		**Overall**	
	Mean	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**
Chemical substance	.99	.84	.99	.84	.99	.67	.98	.55	.99	.70	.99	.84	.99	.96	.991	.545
Personal use item	.99	.55	.99	.84	.99	.84	.99	.55	.99	.75	.99	.83	.99	.85	.991	.545
Appliance	.99	.55	.99	.73	.99	.93	.99	.96	.99	.94	.99	.93	.99	.94	.992	.545
Transport-related products	.97	.75	.99	.57	.99	.57	.99	.74	.99	.74	.99	.56	.99	.78	.987	.562
Natural object or animal	.98	.74	.99	.73	.99	.77	.99	.74	.99	.73	.99	.56	.99	.75	.993	.562
Furnishing	.98	.73	.99	.67	.99	.89	.99	.84	.99	.57	.99	.90	.99	.80	.990	.571
Sporting equipment	1.00	.99	.99	.89	.99	.86	.99	.74	.99	.57	.99	.73	.99	.86	.993	.571
Structure or fitting	.98	.74	.99	.67	.99	.74	.99	.75	.99	.77	.99	.74	.99	.84	.991	.667
Infant or child's product	.97	.74	.99	.84	.99	.73	.99	.90	.99	.88	.99	.85	.99	.95	.992	.735
Miscellaneous	.98	.84	.99	.82	.99	.73	.99	.74	.99	.85	.99	.75	.99	.88	.992	.735
Material	.98	.74	.99	.84	.99	.77	.99	.85	.99	.89	.99	.75	.99	.80	.992	.735
Tool	.97	.84	.99	.80	.99	.77	.99	.80	.99	.97	.99	.90	1.00	.98	.993	.765
Utensil or container	.99	.84	.99	.90	.99	.89	.99	.84	.99	.97	.99	.95	.99	.88	.993	.838
Total	**.98**	**.55**	**.99**	**.57**	**.99**	**.57**	**.99**	**.55**	**.99**	**.57**	**.99**	**.56**	**.99**	**.75**	**.992**	**.545**

Further analysis was conducted to describe the patterns of SRR across different mechanisms of product-related injuries. All mechanisms of injury were ranked from the lowest minimum SRR to the highest. As shown in the Table 6-4, injuries due to thermal effects were shown to rank as the top most severe injuries with a minimum SRR of 0.545 and mean SRR of 0.991. Injuries due to falls and being struck or hit by objects were second in the severity ranking with minimum SRR of 0.571.

Table 6-4 ED-based injury surveillance data – Mean SRR by Mechanism of Injury & Age groups

Mechanism of injury groups	**Age groups Minimum and Mean SRR**															
	< 1		**1 - 3**		**4 - 6**		**7 - 9**		**10 - 12**		**13 - 15**		**16 - 17**		**Overall**	
	Mean	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**
Thermal effect	.99	.55	.99	.85	.99	.94	.98	.55	.99	.88	.99	.83	.99	.94	.991	.545
Fall	.98	.73	.99	.67	.99	.57	.99	.75	.99	.57	.99	.73	.99	.90	.990	.571
Struck, hit by object	.99	.74	.99	.57	.99	.74	.99	.74	.99	.75	.99	.74	.99	.80	.991	.571
Crushing, piercing	.99	.90	.99	.80	.99	.96	.99	.75	.99	.88	.99	.80	.99	.97	.993	.745
Other and unspecified mechanism of injury	1.00	.99	.99	.95	.99	.88	.99	.88	.99	.80	.99	.94	.99	.88	.991	.800
Suffocation	.91	.84	.97	.84	.95	.84	1.00	1.00			1.00	1.00	.99	.99	.951	.838
Chemical effect	.99	.98	.99	.84	.99	.98	1.00	.98	.99	.94	.99	.98	.99	.96	.991	.838
Foreign body	.98	.84	1.00	.89	1.00	.95	1.00	.90	1.00	.99	.99	.90	1.00	.96	.997	.838
Acute over-exertion of body part	.99	.98	1.00	.91	1.00	.86	1.00	.97	1.00	.86	1.00	.94	1.00	.88	.997	.860
Electric, radiation effect	.99	.99	.99	.98	.99	.99	1.00	.99	.99	.99	.99	.96	.99	.98	.993	.961
Overall	**.98**	**.55**	**.99**	**.57**	**.99**	**.57**	**.99**	**.55**	**.99**	**.57**	**.99**	**.73**	**.99**	**.80**	**.992**	**.545**

RAPEX

A product safety based severity rating, RAPEX, was applied to ED-based injury surveillance data. Burn cases were selected as a sample case study to be applied with RAPEX ratings. Overall, 2105 burn cases were identified in ED-based injury surveillance data based on the presence of ICD codes for burns (T20 – T31) and those with a discharge status of admission to hospital were regarded as high severity injuries.

Burn cases in the ED-based injury surveillance data were classified into 'Below severity threshold' (level 1 and 2) and 'Above severity threshold' (level 3 and 4) categories based on the RAPEX severity levels. The outcomes of applying the RAPEX rating system in ED-based injury surveillance burn data is indicated in

Figure 6-12, showing approximately 49% of all burn cases were classified above the severity threshold (RAPEX 3 and 4) and 22% below the severity threshold (RAPEX 1 and 2). Approximately 29% of burn cases were unable to be classified due to unspecified burns thickness.

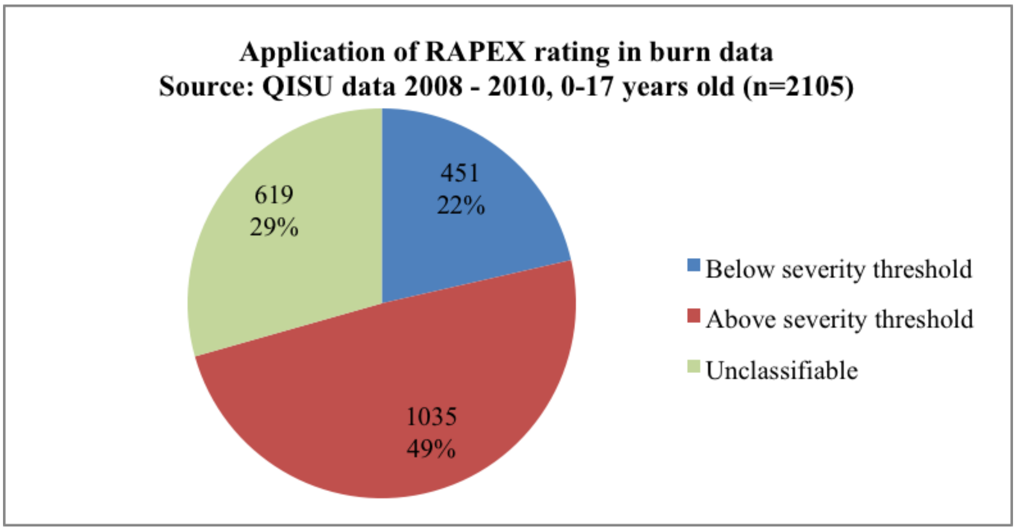


Figure 6-12 RAPEX rating in Burn data

RAPEX ratings were also analysed based on age, and the proportion of cases above the severity threshold (RAPEX 3 -4) was found to fluctuate across age. The proportion of RAPEX 3 – 4 was the highest in children aged 1-3 years old (54%). Meanwhile the lowest proportion of RAPEX 3 – 4 (34%) was found in older children aged 16-17. The greatest proportion of cases below the severity threshold (RAPEX 1 – 2) was in infants under 1 year old (24%) and lowest proportion in the 13-15 year olds (19%).

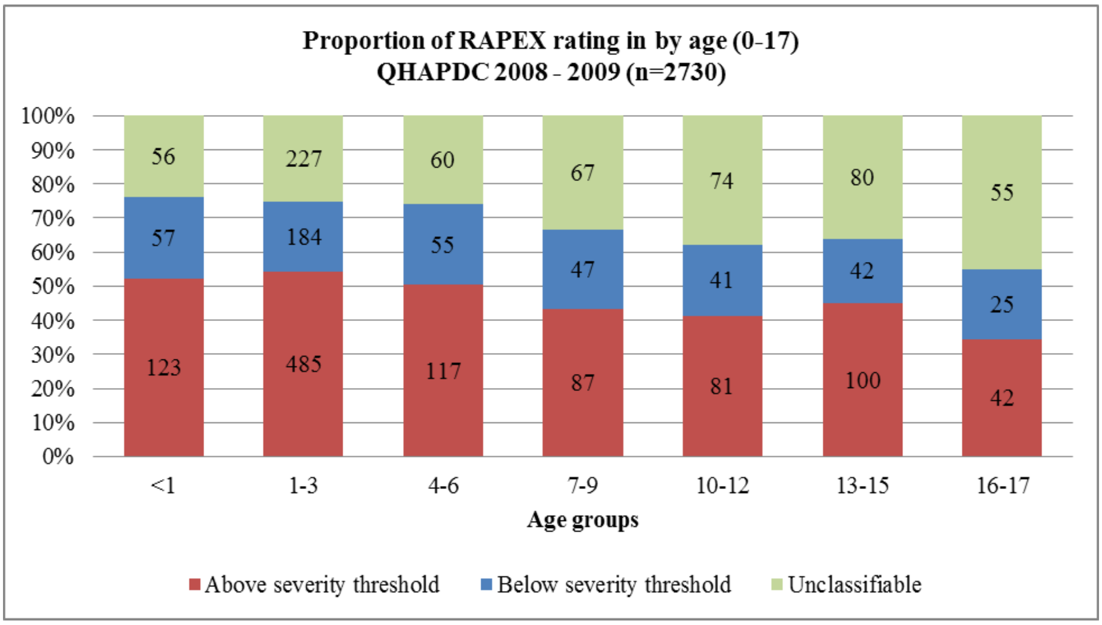


Figure 6-13 RAPEX rating by age groups

In total, 798 burn cases were found to be associated with consumer products, which represent 38% of all burn cases. As shown in Figure 6-14, the proportion of cases above the severity threshold was highest in the consumer products group with more than half of these injuries (51%) classified under RAPEX 3 - 4. Burns from household appliances such as cooking appliances contributed to the high proportion of more severe cases in the product-related injuries category (Appendix 9).

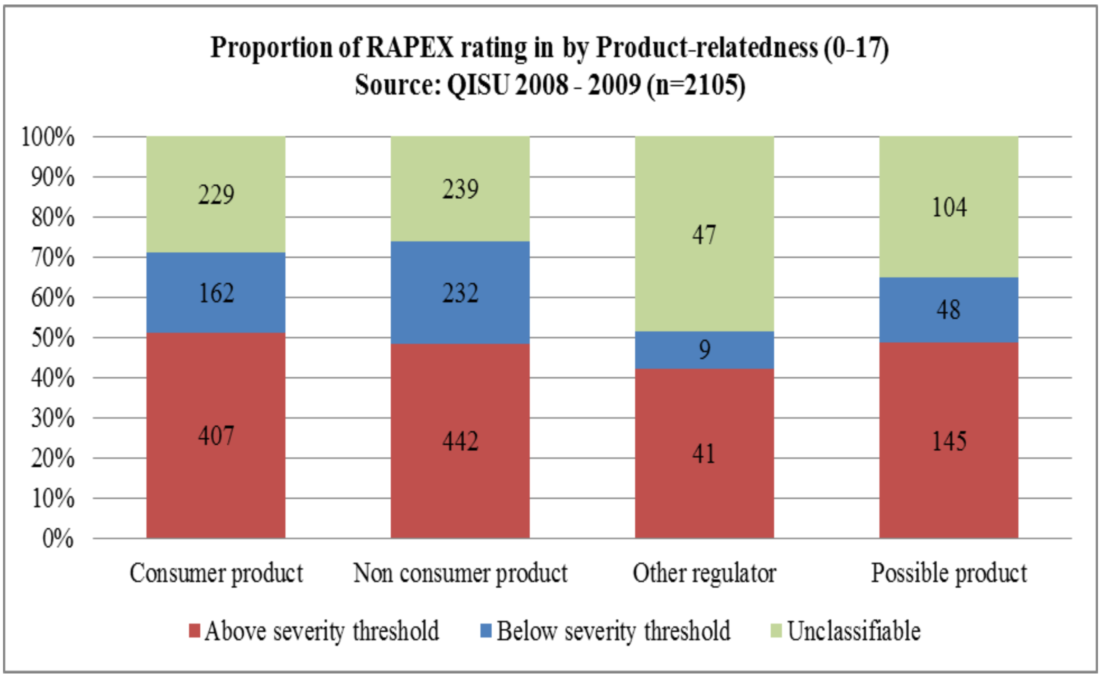


Figure 6-14 RAPEX rating by product-relatedness

Severity Ranking

Prioritisation of product safety issues is often decided upon assessment of the most severe injuries. In this study, all severity measures were combined to rank all mechanisms of injury based on the injury severity. The results from the RAPEX analysis however, were not included in the severity ranking process, as this analysis was only conducted on burn injuries, not all mechanisms. One mechanism of injury, biohazard injuries (4 cases) was excluded from the severity ranking due to the small number of injuries in this mechanism group.

Firstly, using the triage categories, all mechanisms of injury were ranked based on the proportion of high severity injuries, ordered from the highest proportion to the lowest. Based on the results above, injuries relating to chemical effects were first on the ranking, having the highest proportion of high severity injuries (28%) compared to other mechanisms. The injury mechanism of suffocation was the second in the rank, with 18% of high severity injuries. Secondly, using the mode of separation status, the proportion of patients who died or were admitted to the hospital after an ED treatment was calculated for each mechanism of injury. Injuries due to thermal effects were ranked at the top of the list, having the highest proportion of deaths and hospital admissions (33%) compared to other mechanisms. Suffocation injuries were the second in the rank with approximately 27% of injuries in this mechanism being admitted to the hospital or dying in the hospital. Lastly, injury severity based on the SRRs was included in the severity ranking with thermal injuries first in rank, having the lowest minimum SRR of 0.55. Injuries due to falls and being struck by products were second in the rank list with a minimum SRR of 0.57. The severity ranking list is summarised in the prioritisation Table 6-5 below.

The overall severity ranking was obtained by calculating the mean severity from all the severity rankings based on all severity measures. The range of ranks possible was from 1 to 10 with rank closer to 1 indicating higher rank order and higher combined severity. As shown in the Table 6-5, thermal injuries were the top rank with a mean severity ranking of 2, followed by fall and suffocation injuries with mean severity ranking of 3.67.

Table 6-5 Overall severity ranking of product-related injuries in ED-based injury surveillance data

Mechanism group	**TRIAGE**			**ADMISSION**			**SRR**		**OVERALL SEVERITY**	
	N(%) of severe injuries		**Ranking**	**N(%) of admission/ death**		**Ranking**	**Minimum SRR**	**Ranking**	**Mean Severity**	**Ranking**
Thermal effect	**61**	**8.29%**	**4**	**241**	**32.74%**	**1**	**0.545**	**1**	**2.00**	**1**
Fall	**891**	**6.39%**	**5**	**2219**	**15.92%**	**4**	**0.571**	**2**	**3.67**	**2**
Suffocation	**6**	**18.18%**	**2**	**9**	**27.27%**	**2**	**0.838**	**7**	**3.67**	**2**
Chemical effect	153	27.27%	1	113	20.14%	3	0.838	8	4.00	3
Foreign body	54	5.31%	6	126	12.40%	5	0.838	6	5.67	4
Other and unspecified mechanism	13	4.48%	7	25	8.62%	7	0.800	5	6.33	5
Crushing, piercing	79	2.29%	10	323	9.38%	6	0.745	4	6.67	6
Struck, hit by object	229	3.41%	9	546	8.12%	8	0.571	3	6.67	6
Electric, radiation effect	8	11.94%	3	3	4.48%	9	0.961	10	7.33	7
Acute over - exertion of body part	108	3.57%	8	76	2.51%	10	0.860	9	9.00	8
Total	**1602**	**91%**		**3681**	**1.41584**		**0.545**			

6.3.2 Severity of product-related injuries in hospital admission data

Length of Stay

An analysis of 58250 non-fatal unintentional injuries in children reported in the hospital admission data was conducted to describe severity based on Length of Stay (LOS). Overall, the result of the analysis showed a minimum stay of 1 day and a maximum of 137 days, with an average of 1.55 (SD=2.78) days. A calculation of the average of length of stay (ALOS) by age showed that ALOS increased by age with the highest ALOS in teenagers age 17 years old (mean = 2.13 days). Infants under 12 months have slightly higher ALOS compared to other young children (mean = 1.44 days).

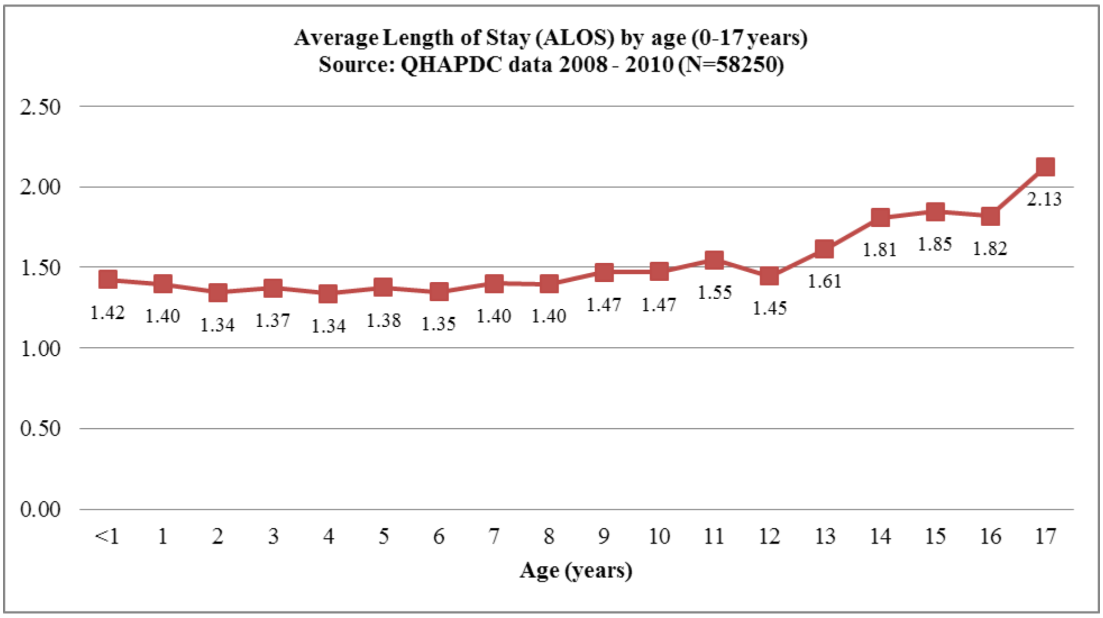


Figure 6-15 Hospital admission data – Average of Length of Stay by age

The ALOS was further analysed based on the product-relatedness obtained from mapping external causes into the 4 product categories described in chapter 5. The result showed that the ALOS calculated for all product-related injuries was 1.55 days. This is lower than other product groups (non-product injuries (1.57 days) and other regulator product injuries (1.81 days). When compared by age, as shown in Figure 6-16, the ALOS for injuries from consumer and other regulator products increased by age with peaks at age 14 years old (2.03 days) for consumer products and at the age of 16 (3.22 days) for injuries from other regulator products. Even though the overall ALOS of consumer product injuries was lower compared to non-product injuries, at the age of 10 – 17 ALOS of consumer product injuries was higher than in non-product injuries.

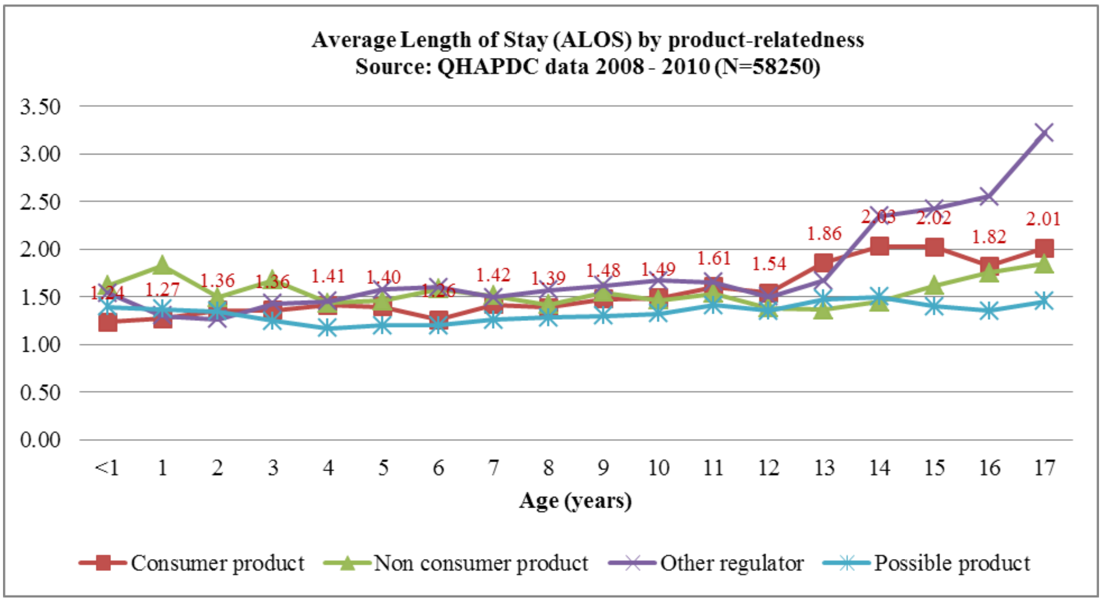


Figure 6-16 Hospital admission data – Average of Length of Stay by product-relatedness

An in-depth analysis of product-related injuries was conducted to identify differences in ALOS for different injury mechanisms and product types and to rank mechanisms of injury based on the severity demonstrated by the longest ALOS. As shown in the Table 6-6, threats to breathing injuries were shown to have the highest ALOS of 2.82 days. The top products causing a high ALOS with this mechanism were batteries (ALOS= 5.5 days) and toys (ALOS= 5 days). At the second rank of ALOS, injuries due to thermal effects were shown to have an ALOS of 2.43 days, in which highly flammable materials with an ALOS of 6.85 days contributed to this high ALOS. This group of products also accounted for the highest ALOS compared to other product groups. Transport accidents were the third ranked ALOS with 2 days. Off-road bikes such as ag-bikes, dirt bikes and trail bikes contributed to the long ALOS (ALOS=2.52 days) in this mechanism. Falls were shown to have the lowest ALOS compared to other mechanisms.

Table 6-6 Hospital admission data – Average Length of Stay by External Cause & Age groups

External cause Mechanism & Product Type	Age groups Average Length of Stay (ALOS) and Maximum Length of Stay (Max LOS)															
	<1		1-3		4-6		7-9		10-12		13-15		16-17		Overall	
	ALOS	Max LOS	ALOS	Max LOS	ALOS	Max LOS	ALOS	Max LOS	ALOS	Max LOS	ALOS	Max LOS	ALOS	Max LOS	ALOS	Max LOS
Threats to breathing	**2.11**	**8**	**1.00**	**1**	**5.00**	**39**	**1.50**	**2**							**2.82**	**39**
Battery	8.00	8			3.00	3									5.50	8
Toy	1.50	2	1.00	1	13.67	39	1.50	2							5.00	39
Furniture	1.40	3													1.40	3
Coin			1.00	1	1.00	1									1.00	1
Plastic bag	1.00	1	1.00	1											1.00	1
Thermal effect	**1.05**	**5**	**1.30**	**24**	**1.63**	**25**	**3.59**	**52**	**4.54**	**63**	**6.36**	**129**	**3.36**	**11**	**2.43**	**129**
Flammable material			13.00	24	5.44	25	8.25	52	6.25	63	8.19	129	2.78	11	6.85	129
Machinery			1.15	7	1.00	1	1.00	1	2.08	8	1.71	6	5.29	11	1.60	11
Household appliance	1.05	5	1.20	21	1.00	1	1.08	2	1.47	8	1.00	1	3.09	10	1.21	21
Transport Accident	**1.00**	**1**	**1.61**	**26**	**1.68**	**34**	**1.89**	**52**	**1.77**	**32**	**2.24**	**106**	**2.37**	**45**	**2.03**	**106**
Ag-bike, dirt-bike	1.00	1	2.18	16	2.52	34	2.34	25	2.10	28	2.58	34	2.87	45	2.52	45
Pedal cycle			1.50	26	1.45	19	1.71	52	1.66	32	2.08	106	1.96	33	1.82	106
Water sport equipment									3.50	6	1.17	2	1.33	2	1.64	6
Pedestrian conveyance			1.00	1	1.50	2	2.11	10	1.00	1	2.17	7	1.25	2	1.54	10
Exposure to electric current or radiation			**1.00**	**1**	**1.00**	**1**	**1.00**	**1**	**1.10**	**2**	**3.33**	**25**	**1.00**	**1**	**1.57**	**25**
Electrical equipment			1.00	1	1.00	1	1.00	1	1.10	2	3.33	25	1.00	1	1.57	25
Drowning	**1.00**	**1**	**1.42**	**14**	**1.15**	**4**	**2.63**	**9**	**2.83**	**10**	**2.00**	**2**	**3.00**	**3**	**1.49**	**14**
Pool	1.00	1	1.44	14	1.15	4	2.63	9	2.83	10	2.00	2	3.00	3	1.51	14
Spa, Jacuzzi/ hot tub	1.00	1	1.00	1											1.00	1
Exposure to mechanical forces	**1.00**	**1**	**1.67**	**47**	**1.68**	**62**	**1.31**	**14**	**1.36**	**18**	**1.44**	**18**	**1.50**	**39**	**1.48**	**62**
Firework											4.40	18	1.00	1	3.83	18
Household devices									1.33	2	2.67	12	4.25	12	3.04	12
Hand tool	1.00	1	2.78	47	2.85	62	1.69	14	1.34	5	1.47	8	1.60	20	1.91	62
Machinery	1.00	1	1.30	7	1.40	11	1.23	2	2.25	18	1.33	9	2.05	39	1.62	39
Jewellery			1.25	2	1.00	1	1.00	1	5.00	9	1.36	3	1.53	6	1.52	9
Sharp object	1.00	1	1.23	15	1.30	8	1.26	4	1.30	5	1.43	16	1.35	7	1.33	16
Sport equipment	1.00	1	1.43	10	1.19	5	1.16	7	1.28	17	1.30	9	1.26	7	1.26	17
Needle					1.00	1					1.50	2	1.00	1	1.20	2
Chemical effect	**1.29**	**7**	**1.47**	**53**	**1.19**	**10**	**2.25**	**20**	**1.32**	**6**	**1.46**	**6**	**1.04**	**2**	**1.42**	**53**
Chemicals	1.29	7	1.47	53	1.19	10	2.25	20	1.32	6	1.46	6	1.04	2	1.42	53
Falls	**1.26**	**22**	**1.22**	**44**	**1.24**	**34**	**1.25**	**18**	**1.31**	**43**	**1.55**	**26**	**1.87**	**15**	**1.29**	**44**
Pedestrian conveyance	1.10	4	1.26	13	1.22	7	1.26	8	1.31	13	1.54	26	1.88	15	1.38	26
Playground equipment	1.00	1	1.33	20	1.23	34	1.25	18	1.33	43	1.69	14	2.39	10	1.29	43
Furniture	1.29	22	1.16	44	1.28	27	1.21	4	1.27	8	1.22	4	1.17	3	1.22	44
Total	**1.24**	**22**	**1.33**	**53**	**1.36**	**62**	**1.43**	**52**	**1.55**	**63**	**1.97**	**129**	**1.92**	**45**	**1.55**	**129**

Mode of separation

Severity was also analysed based on the outcome of treatment in the hospital by looking at the modes of separation. Overall, approximately 90% of all unintentional injury admissions were discharged home or to the usual residence and 9% were transferred or changed to different episode type. There were 59 deaths recorded in the data which accounted for less than 1% of all cases.

As shown in Figure 6-17, the number of deaths was highest in younger children under 3 years old (26 deaths). A higher number of deaths is also noted amongst teenagers age 16-17 years old, with 14 reported deaths. The proportion of episode changes and transfers appeared to be consistent across age groups with the lowest percentage of 8.2% in infants under 1 year old and the highest proportion of 9.7% amongst teenagers aged 16-17 years. Similarly, the proportion of discharges to home or usual residence was also consistent across all age groups with the lowest percentage in the 16-17 year olds (89%) and highest percentage in 10-12 year olds (90.8%).

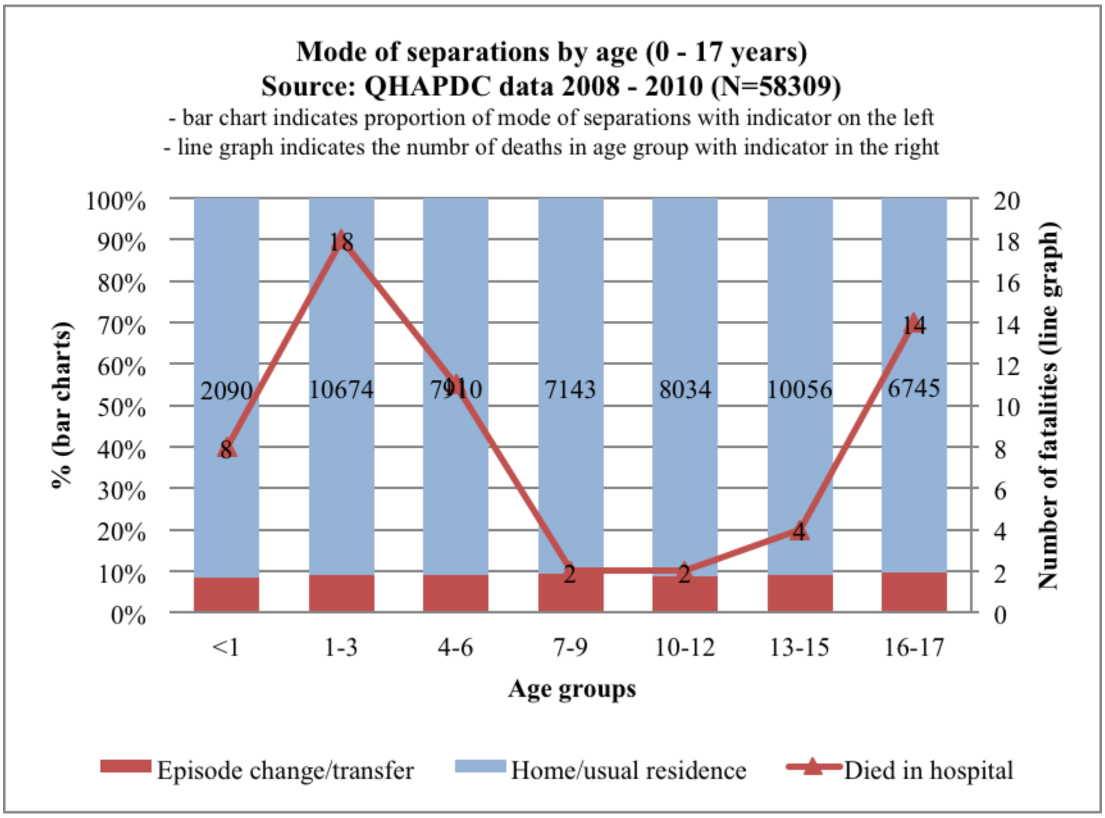


Figure 6-17 Hospital admission data – Mode of separations by age

Further analysis on mode of separation based on product-relatedness was conducted. The result shows a high number of deaths (n=28) and slightly higher proportion of episode changes/transfers (11%) for injuries caused by other regulator products. The number of deaths was also higher for product-related injuries (15 deaths) and possible product injuries (10 deaths). Despite the high number of deaths in these two groups, the proportions of episode changes/transfers were the least compared to other groups, with only 9% for product injuries and 8% for possible product injuries. Non-product injuries had the least number of deaths, however had a slightly higher proportion of episode changes/transfers (10%).

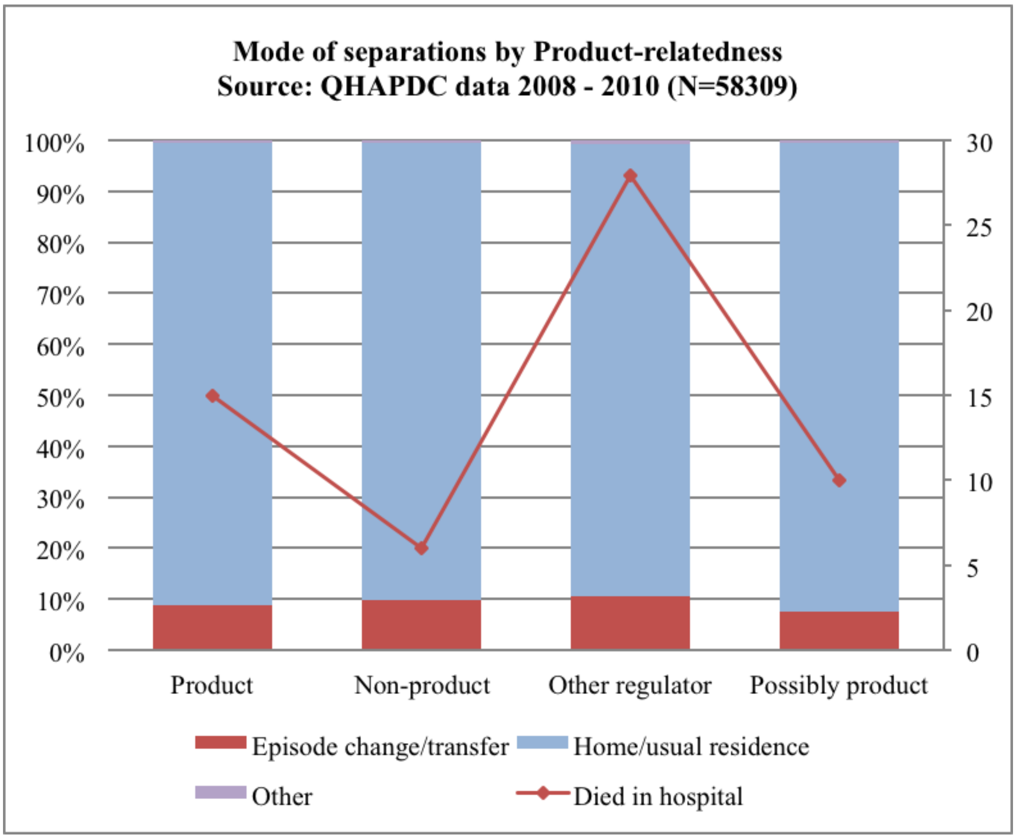


Figure 6-18 Hospital admission data – Mode of separations by Product-relatedness

Mode of separation was analysed based on the mechanism of injury, and the results showed variation in the proportion of episode changes and transfers for different injury mechanisms (Figure 6-19). The proportion of hospital transfers and episode changes was the highest in the injuries due to threats to breathing, accounting for 36%. Drowning was shown to cause the highest number of product-related deaths (10 cases) compared to other mechanisms. This number represented 7% of all recorded drowning cases in the hospital admission data. The ten deaths from drowning occurred in swimming pools (Table 6-7) and there was also a slightly higher proportion of episode changes/transfers (11%) due to drowning. Another mechanism causing deaths was product-related transport accidents with 4 reported deaths. Of these, two deaths were caused by off-road bike accidents and two deaths were on pedal cycles. Approximately 11% of transport accidents were transferred or changed to a different episode type.

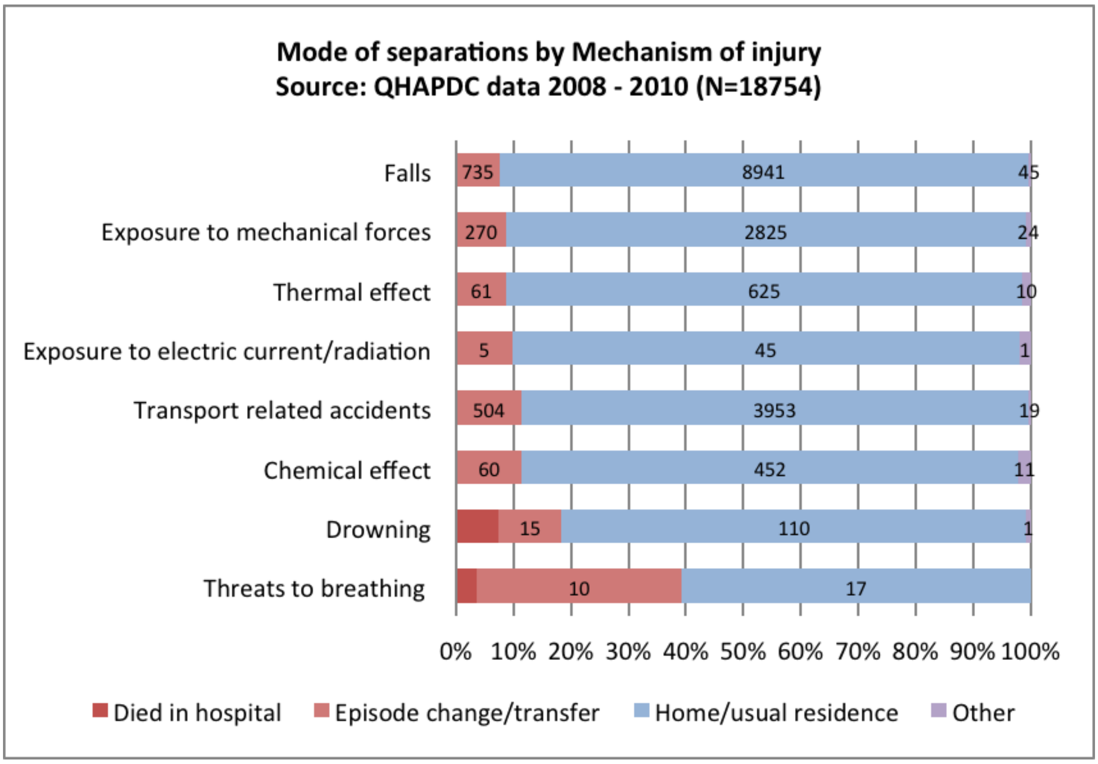


Figure 6-19 Hospital admission data – Mode of separations by Mechanism of injury

In-depth analysis on the product-related injuries was conducted. One death was recorded under this mechanism, and this related to furniture entrapment. The overall number of injuries recorded in this mechanism is very small compared to other mechanisms (See Chapter 5). Injuries due to chemicals also had a slightly higher proportion of episode changes/transfers (11%) compared to other mechanisms. Falls had the lowest proportion compared to other mechanisms with 8% being transferred or changed to a different episode type. Despite the small proportion, falls had the highest frequency of episode changes/transfers (n=735) due to the high overall frequency of the falls.

Table 6-7 Hospital admission data - Mode of separations by External Cause

External cause (Mechanism & product)	Mode of separation								
	Died in hospital		Episode change/ transfer		Home/usual residence		Other		Total
	n	%	n	%	n	%	n	%	n
Threats to breathing	**1**	**4%**	**10**	**36%**	**17**	**61%**			**28**
Battery					2	100%			2
Coin			4	44%	5	56%			9
Furniture	1	20%			4	80%			5
Plastic bag			1	50%	1	50%			2
Toy			5	50%	5	50%			10
Drowning	**10**	**7%**	**15**	**11%**	**110**	**81%**	**1**	**1%**	**136**
Pool	10	8%	15	11%	105	80%	1	1%	131
Spa, Jacuzzi and hot tub					5	100%			5
Transport Accident	**4**	**<1%**	**504**	**11%**	**3953**	**88%**	**19**	**<1%**	**4480**
Ag-bike, dirt-bike, Trail bike	2		211	15%	1159	84%	6	<1%	1378
Pedal cycle	2		291	10%	2750	90%	13	<1%	3056
Pedestrian conveyance			2	6%	33	94%			35
Water sport equipment					11	100%			11
Chemical effect			**60**	**11%**	**452**	**86%**	**11**	**2%**	**523**
Chemicals			60	11%	452	86%	11	2%	523
Electric current or radiation			**5**	**10%**	**45**	**88%**	**1**	**2%**	**51**
Electrical equipment			5	10%	45	88%	1	2%	51
Thermal effect			**61**	**9%**	**625**	**90%**	**10**	**1%**	**696**
Hot household appliance			29	6%	415	93%	4	1%	448
Highly flammable material			26	18%	112	78%	6	4%	144
Machinery			6	6%	98	94%			104
Exposure to mechanical forces			**270**	**9%**	**2825**	**91%**	**24**	**1%**	**3119**
Firework			3	50%	3	50%			6
Hand tool powered/non-powered			59	10%	530	89%	4	1%	593
Household devices			3	13%	19	83%	1	4%	23
Jewellery			3	7%	41	93%			44
Machinery			32	10%	291	90%	1	<1%	324
Needle			1	20%	4	80%			5
Sharp object			118	8%	1338	91%	16	1%	1472
Sport equipment			51	8%	599	92%	2	<1%	652
Falls			**735**	**8%**	**8941**	**92%**	**45**	**<1%**	**9721**
Furniture			179	7%	2388	92%	23	1%	2590
Pedestrian conveyance			179	7%	2298	92%	9	<1%	2486
Playground equipment			377	8%	4255	92%	13	<1%	4645
Total	**15**	**0%**	**1660**	**9%**	**16968**	**90%**	**111**	**1%**	**18754**

ICISS

Severity of injury was also analysed using the International Classification of Disease Injury Severity Score (ICISS). The Survival Risk Ratio (SRR) list obtained from the National Injury Surveillance Unit was used to assign severity scores to hospital admission data allowing the calculation of ICISS score. The severity of injury increases as the value of ICISS decreases. Overall, an average of 0.985 ICISS was calculated from all admission unintentional injuries in children. As shown in Figure 6-20, ICISS score was low on average amongst the younger children and teenagers. The lowest mean ICISS, indicating the most severe injury, was calculated amongst the oldest age group aged 16-17 with a mean of 0.98. Infants under 1 year of age were also vulnerable to a low ICISS score with a mean of 0.982.

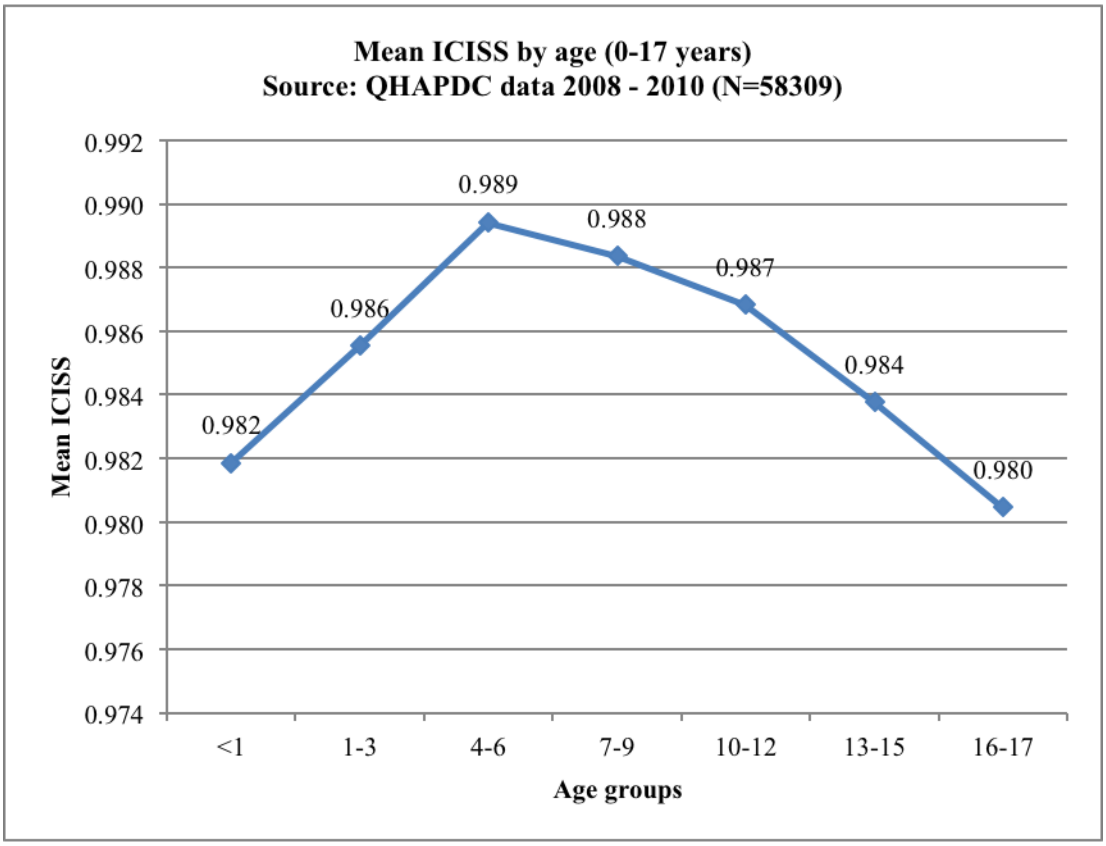


Figure 6-20 – Hospital admission data – Mean ICISS by age

Further analysis of ICISS scores for product flag groups showed a variety of patterns across age groups. Overall, injuries from other regulated products had the lowest mean ICISS of 0.981. This was followed by non-product injuries (Mean = 0.984), product injuries (Mean = 0.986) and the highest mean ICISS of 0.99 in possible product injuries. As shown in the Figure 6-21, the mean ICISS of injuries due to consumer products and other regulator products decreased by age, indicating an increase in severity as the children grow older. Compared to other age groups, injuries from other regulator products had the lowest mean ICISS amongst the teenagers aged 16-17 years old with the mean ICISS of 0.964. Similarly, injuries from consumer products had the lowest mean ICISS of 0.98 in teenagers aged 16-17 years old. Non-product injuries, on the other hand, had a different pattern across age groups. Younger children had lower mean ICISS compared to older children with the lowest being 0.975 in toddlers aged 1-3 years.

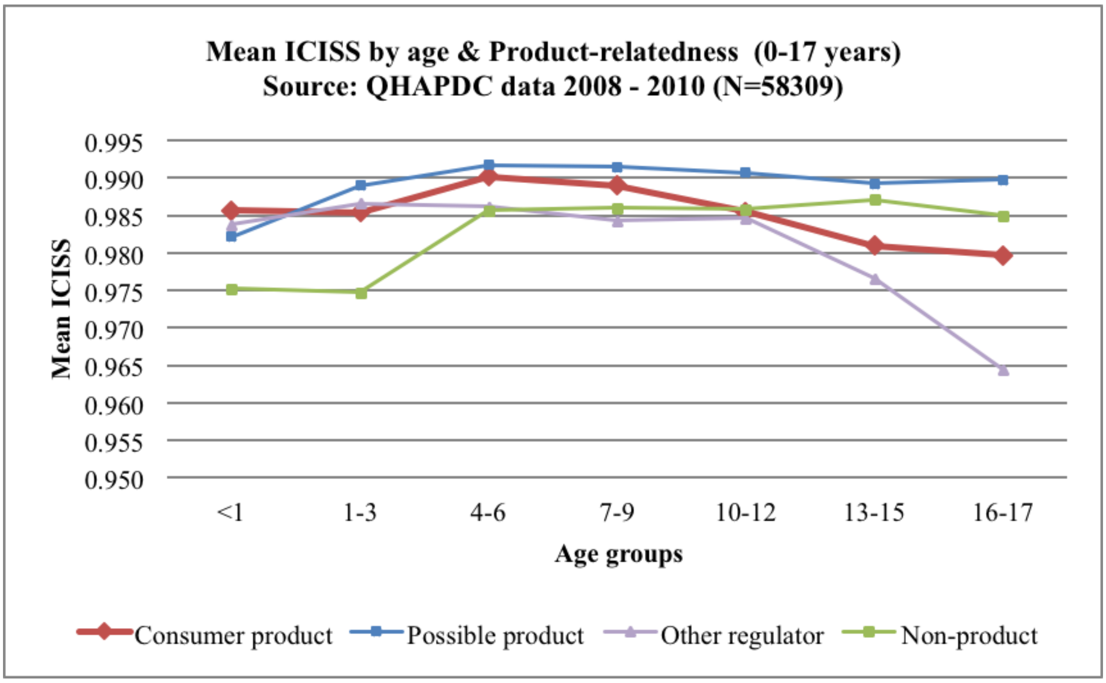


Figure 6-21 Hospital admission data – Mean ICISS by Product-relatedness

The mean and minimum ICISS score were calculated based on the mechanism of injury groups. All mechanisms of injury were then ranked from the lowest minimum ICISS score to the highest. As shown in the Table 6-8, injuries due to transport accidents were shown to rank the top most severe injuries with a minimum ICISS score of 0.054 and mean ICISS score of 0.975. Injuries involving off-road bikes contributed to the low ICISS score for this mechanism of injury group. Injuries due to exposure to electric current and radiation were second in the severity ranking with a minimum ICISS score of 0.338 and mean ICISS score of 0.949. Drowning injuries were last in the severity ranking based on ICISS scoring with a minimum

ICISS score of 0.96. Firework injuries under this mechanism were found to have the lowest mean ICISS compared to other product groups.

Table 6-8 Hospital admission data – Mean ICISS by Mechanism of injury (n=18754)

External cause Mechanism & Product Type	Age groups by ICISS Score														Overall	
	<1		1-3		4-6		7-9		10-12		13-15		16-17			
	Mean	Min	Mean	Min	Mean	Min	Mean	Min	Mean	Min	Mean	Min	Mean	Min	Mean	Min
Transport Accident	**.980**	**.978**	**.980**	**.345**	**.978**	**.054**	**.979**	**.439**	**.977**	**.504**	**.974**	**.468**	**.965**	**.314**	**.975**	**.054**
Ag-bike, dirt-bike	.980	.978	.945	.345	.951	.054	.970	.439	.973	.684	.970	.501	.961	.314	.967	.054
Pedal cycle			.986	.945	.985	.749	.982	.672	.979	.504	.976	.468	.970	.359	.978	.359
Pedestrian conveyance			.978	.976	.985	.976	.975	.919	.973	.837	.971	.947	.984	.960	.976	.837
Water sport equipment									.972	.960	.979	.959	.933	.814	.965	.814
Electric current/radiation			**.971**	**.956**	**.977**	**.968**	**.978**	**.957**	**.972**	**.956**	**.872**	**.338**	**.973**	**.956**	**.949**	**.338**
Electrical equipment			.971	.956	.977	.968	.978	.957	.972	.956	.872	.338	.973	.956	.949	.338
Mechanical forces	**.987**	**.974**	**.988**	**.728**	**.989**	**.876**	**.990**	**.926**	**.989**	**.424**	**.991**	**.777**	**.993**	**.626**	**.991**	**.424**
Firework											.918	.788	.986	.986	.932	.788
Hand tool	.983	.974	.986	.728	.989	.919	.988	.935	.993	.925	.993	.917	.994	.960	.991	.728
Household devices									.974	.974	.962	.777	.976	.960	.968	.777
Jewellery			.993	.987	.989	.987	.988	.987	.982	.978	.991	.985	.988	.966	.989	.966
Machinery	.984	.984	.979	.842	.979	.876	.991	.961	.987	.950	.995	.962	.996	.967	.989	.842
Needle					.998	.998					.994	.993	.999	.999	.997	.993
Sharp object	.990	.984	.993	.938	.994	.972	.993	.929	.994	.965	.993	.921	.992	.626	.993	.626
Sport equipment	.992	.990	.990	.968	.985	.911	.986	.926	.984	.424	.989	.823	.990	.873	.987	.424
Falls	**.986**	**.918**	**.988**	**.660**	**.993**	**.660**	**.992**	**.501**	**.991**	**.851**	**.987**	**.800**	**.983**	**.764**	**.990**	**.501**
Furniture	.986	.918	.988	.927	.990	.660	.989	.840	.990	.920	.983	.829	.987	.947	.988	.660
Pedestrian conveyance	.986	.940	.982	.660	.990	.945	.990	.501	.989	.851	.987	.800	.985	.764	.988	.501
Playground equipment	.986	.940	.990	.823	.994	.920	.993	.862	.993	.908	.988	.844	.970	.793	.992	.793
Chemical effect	**.992**	**.885**	**.975**	**.573**	**.989**	**.939**	**.992**	**.927**	**.983**	**.939**	**.990**	**.943**	**.988**	**.904**	**.980**	**.573**
Chemicals	.992	.885	.975	.573	.989	.939	.992	.927	.983	.939	.990	.943	.988	.904	.980	.573
Thermal effect	**.981**	**.906**	**.978**	**.873**	**.972**	**.710**	**.971**	**.912**	**.963**	**.762**	**.959**	**.819**	**.950**	**.741**	**.972**	**.710**
Household appliance	.981	.906	.979	.873	.982	.949	.987	.983	.983	.956	.973	.939	.957	.900	.979	.873
Flammable material			.956	.919	.902	.710	.961	.927	.955	.762	.955	.819	.942	.741	.951	.710
Machinery			.975	.932	.982	.956	.963	.912	.963	.939	.967	.927	.955	.927	.971	.912
Threats to breathing	**.963**	**.929**	**.998**	**.996**	**.991**	**.974**	**.955**	**.929**							**.986**	**.929**
Battery	.997	.997			.997	.997									.997	.997
Coin			.996	.996	.993	.986									.994	.986
Furniture																
Plastic bag																
Toy	.929	.929	1.000	1.000	.984	.974	.955	.929							.974	.929
Drowning					**.998**	**.998**	**.975**	**.960**							**.983**	**.960**
Pool					.998	.998	.975	.960							.983	.960
Spa, Jacuzzi/hot tub																
Total	**.986**	**.885**	**.985**	**.345**	**.990**	**.054**	**.989**	**.439**	**.985**	**.424**	**.981**	**.338**	**.980**	**.314**	**.986**	**.054**

RAPEX

A product safety-based severity rating was applied to hospital admission data. Burn cases were selected as a sample case study to be assessed with the severity rating system, RAPEX. Overall, 2791 burn cases were identified in hospital admission data based on extraction of ICD codes for burns (T20 – T31).

The outcome of the RAPEX rating system in admission burn data is indicated in Figure 6-22. The result showed that a large number of cases were 'double rated' (see boxes C1, C2, C3, C4 and D4 in the RAPEX ICD matrix provided in Table 6-2 above). This is due to the BSA range difference in RAPEX severity ratings and ICD-10-AM. Approximately 64% of all burn injuries identified were in level 1 and 2; 6% were in level 2 and 3; and less than 1% were in level 3 and 4. 137 cases were unclassifiable due to unspecified body surface area burned. However, there is a possibility that multiple burn injuries were coded under this group.

In the product safety system, cases classified under severity level 3 and 4 are prioritised for intervention. Therefore, for further analysis of hospital admission data, RAPEX severity levels were assigned to one of two groups 'Below severity threshold' (level 1 and 2) and 'Above severity threshold' (level 3 and 4). Approximately 69% of all burn cases were classified under the severity threshold and 26% above the severity threshold.

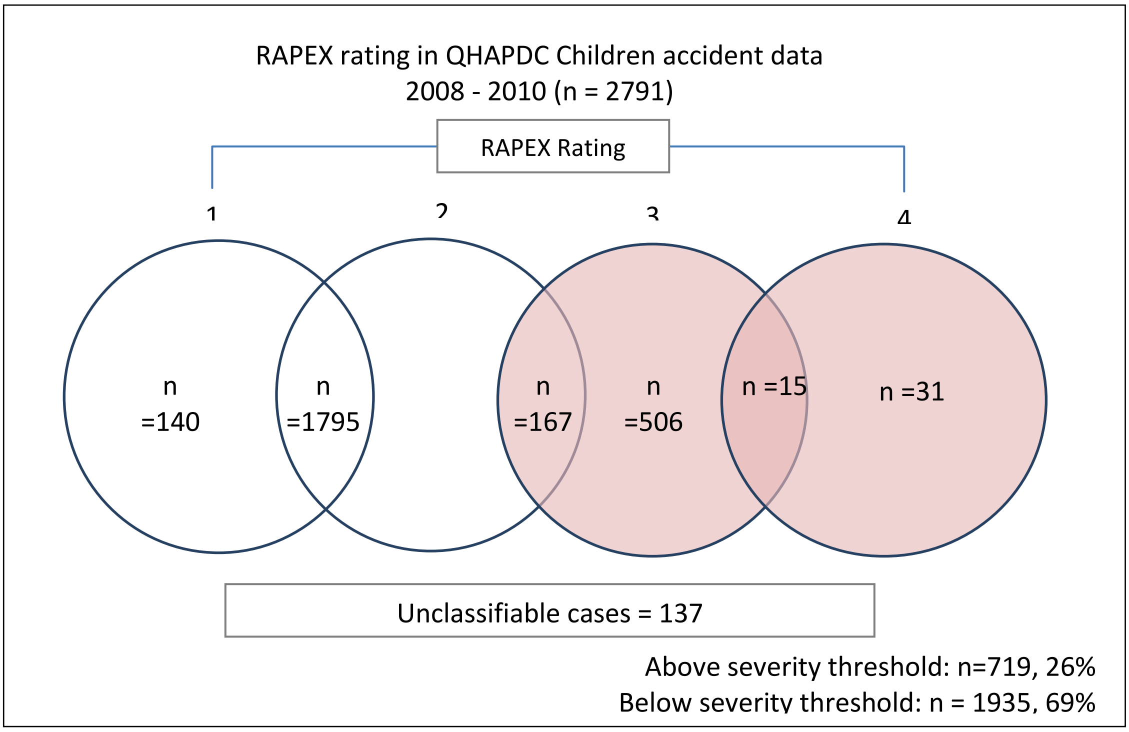


Figure 6-22 Hospital admission data – RAPEX Ratings Application Diagram Venn

RAPEX ratings were also analysed based on age in which the proportion of cases above the severity threshold (RAPEX 3 -4) was found to increase by age. The proportion of RAPEX 3 – 4 was found to be the highest in children aged 13-17 years old (38%). Meanwhile the lowest proportion of RAPEX 3 – 4 (15%) was found in infants under 1 year of age. Conversely, the proportion of cases below the severity threshold (RAPEX 1 – 2) was highest in younger children aged under 1 year (82%) and lowest in older children age 13-15 years old (52%) .

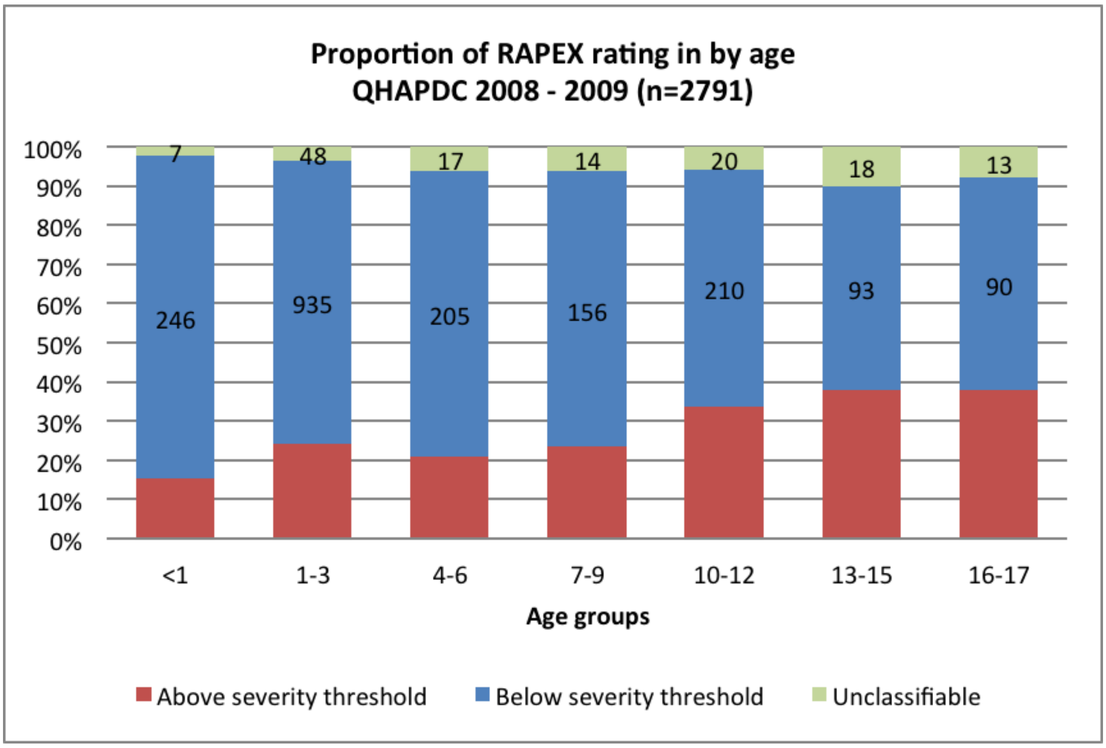


Figure 6-23 Hospital admission data – RAPEX Ratings by age

Analysis of RAPEX ratings based on product-relatedness found 944 burn cases to be associated with consumer products, representing 34% of all burn cases. As shown in Figure 6-24, the proportion of RAPEX 1 – 4 was highest in burns caused by other regulator products (40%). Consumer product burns had the second highest proportion of RAPEX 3 -4 (29%) severity injuries. Burns from highly flammable materials and machinery tools contributed to the high proportion of more severe cases in product injuries. Inflammable materials accounted for 25% of all RAPEX 3-4 burns in product injuries, whereas machinery tools accounted for 14%.

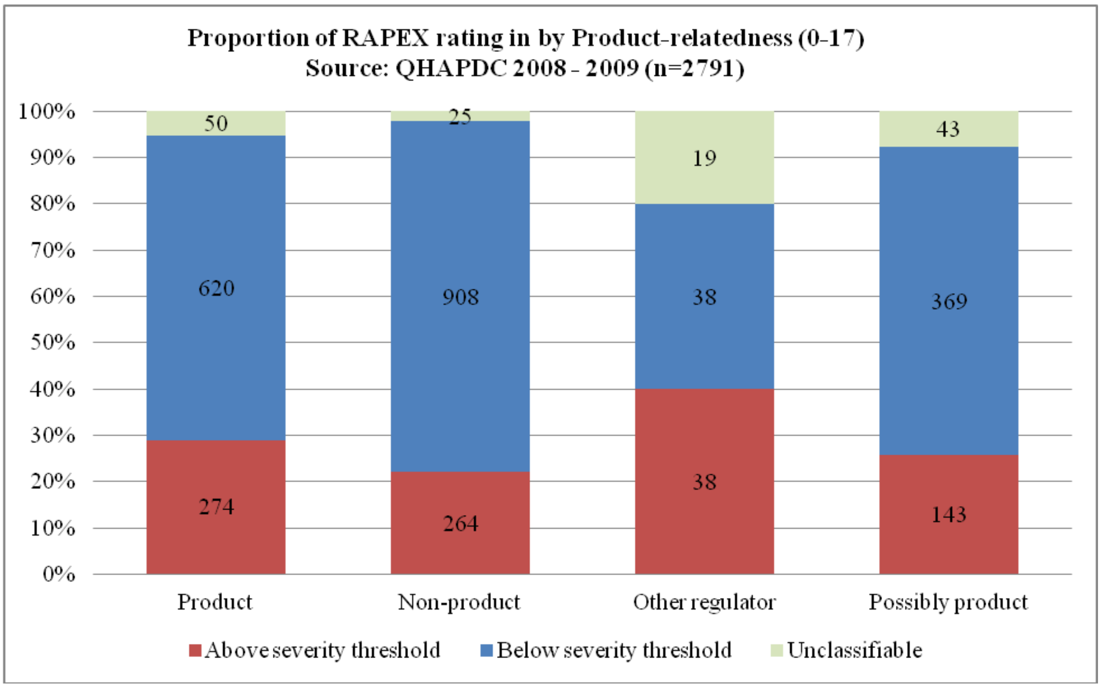


Figure 6-24 Hospital admission data – RAPEX Ratings Application by Product-relatedness

Severity Ranking

In this study, all severity measures were combined to rank the external cause categories based on the combined injury severity. The results from the RAPEX analysis however, were not included in the severity ranking process, as this analysis was only conducted on burn injuries not all external cause groups. Two non-product-related external cause groups were excluded from the severity ranking, including injuries due to contact with animals and plants and injuries due to forces of nature.

All external causes of injuries were ranked based on the ALOS, from the highest to the lowest. Injuries related to threats to breathing were highest on the ranking with an ALOS of 2.82 days. Thermal injuries were the second in the rank with an ALOS of 2.43 days. Furthermore, using the mode of separation, the proportion of patients who died or were transferred to another hospital after admission was calculated for each mechanism of injury group. Injuries due to threats to breathing were ranked at the top of the list, having the highest proportion of deaths and hospital transfers (36%) compared to other mechanisms. Drowning was the second in the rank with approximately 11% of drowning injuries being transferred to another hospital or changing episode type, and 10 drowning cases resulted in death. Lastly, injury severity based on the ICISS scoring was included in the severity ranking in which transport accidents were first ranked, having the lowest minimum ICISS score of 0.054. Injuries due to exposure to electric current or radiation were second in the rank list with minimum ICISS score of 0.338. The severity ranking list is summarised in the prioritisation Table 6-9 below.

The overall severity ranking was obtained by calculating the mean severity from all the severity rankings based on all severity measures. As shown in the Table 6-9, transport accidents were the top in the ranking, with a mean severity of 2.7, followed by threats to breathing with a mean severity of 3 and exposure to electric current or radiation injuries with a mean severity of 3.7. The injuries due to threats to breathing dropped down to second ranking due to the ICISS score (rank 7), although this mechanism of injury group was first in the rank using all other severity measures.

Table 6-9 Overall severity ranking of product-related injuries in hospital admission data

Mechanism	Average Length of Stay (ALOS)	ALOS Ranking	Number of death/ transfer	% of death/transfer	Severe outcome ranking	Minimum ICISS	ICISS ranking	Mean Severity Ranking	Severity Ranking
Product-related transport accidents	2.03	3	508	11.34%	4	0.0540	1	2.7	**1**
Threats to breathing	2.82	1	11	39.29%	1	0.9291	7	3.0	**2**
Electric current or radiation	1.57	4	5	9.80%	5	0.3375	2	3.7	**3**
Thermal effect	2.43	2	61	8.76%	6	0.7097	6	4.7	4
Drowning	1.49	5	25	18.38%	2	0.9601	8	5.0	5
Chemical effect	1.42	7	60	11.47%	3	0.5732	5	5.0	6
Exposure to mechanical forces	1.48	6	270	8.66%	7	0.4241	3	5.3	7
Falls	1.29	8	735	7.56%	8	0.5009	4	6.7	8
Total	**1.82**		**1675**						

6.4 DISCUSSION

6.4.1 Comparisons of findings in ED-based injury surveillance and hospital admission data

This chapter presents results of severity analyses on two Queensland injury data sources – ED-based injury surveillance and hospital admission data. In this study, multiple measures were interpreted concurrently in order to provide more context to injury and therefore act as proxy indicators of severity. The severity measures used in this study were based on several severity concepts. The SRR and ICISS for example are measures of severity based on threats to life, whereas length of stay, hospital admission and episode change/transfer to another hospital are based on the need for treatment. The triage scoring which is used in ED-based injury surveillance data is based on the urgency of treatment required to treat the injury.

These severity measures were used to examine the severity of injuries caused by different mechanisms of injury and to rank these mechanisms of injury based on all severity measures. The mechanisms of injury that resulted in the most severe injury presenting to emergency departments were identified in the ED-based injury surveillance data analysis (RQ 6.1). Three injury surveillance-based severity measures were used in this analysis including triage categories, mode of separation and SRR. Furthermore, the mechanisms of injury that resulted in the most severe injury for cases admitted to hospital were identified in the hospital admission data analysis (RQ 6.2). Three hospitalisation-based severity measures were used in this analysis including length of stay, mode of separation and ICISS scoring.

Mode of separation was used as a severity measure in the analyses of both injury surveillance data and hospital admission data. However, the categories in the mode of separation fields from both datasets were different as they represent different levels of care in the hospital. In ED-based injury surveillance data, the mode of separation represents the referral destination of patients after treatment in the ED, whereas in hospital admission data, the mode of separation represents the referral destination of patients after admission to the hospital. In ED-based injury surveillance data, severity of injury was measured based on the proportion of injuries resulting in death or admission to the hospital after treatment in the ED. In hospital admission data, severity of injury was measured based on the proportion of injuries resulting in death or transfer to another hospital or change of episode type.

Based on the analysis of mode of separation data, injuries due to thermal effects had the highest proportion of hospital admission in ED-based injury surveillance data with 33% of injuries in this mechanism being admitted or transferred to hospital. In the hospital admission data, the proportion of hospital transfers and episode type changes was the highest for the injuries due to threats to breathing, which include strangulation and suffocation, accounting for 36%. This difference in the results of mode of separation in both datasets may be explained by the difference in level of care represented in both datasets capture.

The SRR was used as the severity measure in the analyses of ED-based injury surveillance data and hospital admission data. ICD codes in both datasets were used to assign an SRR to each injury case. However, there were differences in the application of SRRs in both datasets due to the availability of ICD codes. ED-based injury surveillance data only includes one stored ICD code which is the principal diagnosis of the injury, therefore, only a single SRR was assigned to each injury case. Hospital admission data on the other hand, contains the full set of ICD principal and additional diagnoses, and SRRs from all ICD codes in each injury case were multiplied to obtain the ICISS score.

The use of SRRs in ED-based injury surveillance data is subject to a question relating to reliability as it has only previously been used for hospital admission data where co-morbid conditions are coded. It has not been used previously for emergency department single diagnosis data. Hence, it may not be as valid as a severity indicator for ED cases as it is for hospital cases. Moreover, using SRRs in isolation is not as reliable as the full ICISS scoring based on the complete range of ICD diagnosis codes. However, the SRR severity measure is the only available injury based severity measure applicable for ED injury data as it only includes the principal diagnosis. This severity measurement was used as a proxy indicator of severity to other severity measures.

The severity ranking based on an SRR analysis of ED-based injury surveillance data showed the lowest minimum SRR amongst injuries due to thermal effects, with a minimum SRR of 0.545. This finding was confirmed by the findings in the mode of separation analysis, in which thermal effect injuries were also the top rank of the severity ranking. Injuries due to falls and being struck or hit by an object were second in the severity ranking with minimum SRR of 0.571. The severity ranking based on the ICISS score analysis in hospital admission data showed slightly different results, with transport accidents shown to rank the top for the most severe injuries with a minimum ICISS score of 0.054. This group of hospitalised injuries include injury cases that are related to transport products that are regulated under consumer product safety such as bicycles and off-road motorbikes. Injuries due to electric currents or radiation were second in the severity ranking with a minimum ICISS score of 0.338.

The triage category analysis was conducted to describe the injury severity in ED-based injury surveillance data. Triage categories as a tool to prioritise patients for emergency department treatment, are only available in emergency department data. In this study, triage categories were further categorised into three severity groups: high severity (triage category 1 and 2), medium severity (triage category 3) and low severity (triage category 4 and 5). Based on the categorisation above, injuries due to chemical effects had the highest proportion of high severity injuries with approximately 28% of injuries under this mechanism requiring resuscitation or ED treatment within 10 minutes. At the second rank of severity, 18% of suffocation injuries were classified as high severity.

The use of triage categories as a severity measure is subject to several issues. Firstly, the triage scoring scales were designed mainly to reflect on the urgency of ED treatment and may not necessarily reflect on injury severity (FitzGerald, et al., 2010). Secondly, triage categorisation may be affected by the previous treatment a patient receives prior to presenting to the ED. For example, an injured patient who has been stabilised by ambulance staff may be categorised at the lower end of the triage scale. Including the admission source may be useful to take into account the pre-ED treatment. However, this information is not yet included as an ED-based injury surveillance data item.

In the hospital admission data analysis, length of stay represented by the number of days a patient stayed in the hospital was used as a severity indicator. The results showed that injuries due to threats to breathing had the highest ALOS of 2.82 days. This was followed by injuries due to thermal effects, which were second on the severity ranking with ALOS of 2.43 days. This finding confirms the results from the severity analysis based on mode of separation in which the threats to breathing mechanism was also ranked as the top severity ranking.

A product safety-based severity scoring system, RAPEX, was applied in both datasets. Based on the mapping of ICD codes into RAPEX severity levels (Appendix 8), burn injuries were selected for this analysis as ICD burn codes were aligned with the categorisation of burn RAPEX severity rating system. The application of RAPEX severity ratings in other mechanisms can be challenging due to the different alignment of the injury conditions in the classification system. The analysis was not able to be conducted to apply the RAPEX severity rating to all product-related injuries as it was beyond the scope of the research. This study was only aimed at assessing the feasibility of using the RAPEX system in injury data.

The application of RAPEX severity levels in both ED-based injury surveillance and hospital admission data showed several differences. The application of RAPEX severity levels in ED-based injury surveillance data was conducted based on burn thickness and admission status only, whereas in hospital admission data, burn thickness, burn surface area (BSA) and procedures performed during the hospital stay were all included. This contributed to the difference in the results in which more burn cases were classified above the severity threshold in ED-based injury surveillance data than in hospital admission data. Approximately 49% of all burn cases were classified above the severity threshold (RAPEX 3 and 4) and 22% below the severity threshold (RAPEX 1 and 2) in ED-based injury surveillance data. Meanwhile in hospital admission data, approximately 26% of all burn cases were classified above the severity threshold and 69% under the severity threshold.

In the application of RAPEX severity ratings, it is important to account for the age of the injured person. For instance, two injured persons with the same burn thickness can be classified differently in the RAPEX system due to age. In this study, the inclusion of procedure codes in the hospital admission data is intended to address this consideration as younger children would normally be treated with additional procedures. Similarly, in the application of RAPEX severity ratings in the ED-based injury surveillance data, the admission status was included as younger children are often admitted to the hospital for additional treatment.

The information about burn surface area played a significant part in the RAPEX categorisation. However, this information is not included in the data as it is often coded as an additional ICD diagnosis code which is not included in ED-based injury surveillance data. Furthermore, around 5% of burn cases in hospital admission data were unclassifiable in the application of the RAPEX severity level due to an unspecified body surface area burned. The information about burn surface area may be complemented by incorporating the use of medical procedures and modes of separation status.

6.4.2 Prioritisation of product safety issue

The overall severity ranking was obtained by calculating the mean severity from all the severity rankings based on all severity measures. Based on the results from the ED-based injury surveillance data analysis, injuries due to thermal effect, falls and suffocation injuries were the top three mechanisms of injury that resulted in the most severe injury presenting to emergency departments (RQ 6.1). This finding was obtained based on severity analysis using triage categories, mode of separation and SRR. Based on the results from the hospital admission data analysis, injuries due to product-related transport accidents, threats to breathing and exposure to electric currents and radiation were the top three mechanisms of injury that resulted in the most severe injuries for patients admitted to hospital (RQ 6.2). This finding was obtained based on a severity analysis using length of stay, mode of separation and ICISS scoring system. There are several differences in these results that may be affected by the difference in the level of care between emergency department and hospital admission. However, injuries due to threats to breathing (which include strangulation and suffocation) appeared to be significant mechanisms in both emergency department and hospitalisation severity rankings.

The results from the severity analysis in this study are consistent with the findings from a previous study by Watson et al (2000) looking at the severity of product-related injuries in terms of hospitalisation and deaths. Choking, strangulation and burns were listed in the leading cause of deaths amongst children under the age of 15 (Watson, et al., 2000) similar to the results from the ED-based surveillance system and the hospital admission data analyses. Falls were found to be the leading cause of hospitalisation in children under 15 years old (Watson, et al., 2000). This is consistent with the findings from the ED-based injury surveillance data analysis.

In comparison with the results in chapter 5, mechanisms of injury that resulted in the most severe injury tend to be lower in frequency. Injuries due to suffocation, electricity and radiation effects, chemical effects and thermal effects, which resulted in the most severe injuries based on the findings in this chapter, were ranked in the bottom 5 of the frequency rankings in chapter 5. This illustrates the complexity of the prioritisation process for product safety regulation with frequency and severity both important considerations in determining responses to hazards. Different responses may be indicated depending on where the emphasis is placed – frequency or severity.

6.5 CONCLUSION

This chapter outlined several methods for describing severity of injuries in ED-based injury surveillance (i.e. QISU) and admission (i.e. QHAPDC) data. Hospitalisation based severity measures such as length of stay, mode of separation and the ICISS scoring system were used to analyse severity in hospital admission data. ED-based injury surveillance based severity measures such Triage score, mode of separation and SRR were used to analyse severity in ED-based injury surveillance data. In addition to these methods, the product safety based severity measure, RAPEX, was also used in the analysis of severity using burn cases as a case study. As a result of utilising these approaches, this study has examined the overall injury severity to prioritise product safety initiatives for those products of concern that cause the most severe injuries. Based on the results from the ED-based injury surveillance data analysis, injuries due to thermal effects, falls and suffocation were the top three mechanisms of injury that resulted in the most severe injury presenting to emergency departments. Moreover, based on the results from the hospital admissions data analysis, injuries due to transport accidents, threats to breathing and exposure to electric currents and radiation were the top three mechanisms of injury that resulted in the most severe injury for patients admitted to hospital.

Chapter 7: Causality of product related injuries

Chapter 7: Causality of product related injuries

7.1 INTRODUCTION

The implementation of the Australian Consumer Law in 2011 highlighted the need for better use of injury data to improve the effectiveness and responsiveness of product safety initiatives. In the product safety system, resources are allocated to different priority issues using risk assessment tools. Injury data is required as a basic input to the risk assessment process. One of the challenges in utilising admitted patient data in the Product Safety system is that clinically coded data have a limited ability to inform the level of product involvement in an injury event.

In Queensland health data, text narratives that can potentially provide relevant product information are collected in emergency departments and stored in the Emergency Department Information System (EDIS) database and the Queensland Injury Surveillance Unit (QISU) database. In these databases, a text field is used to document the presenting problem as recorded by the triage nurse/s at a patient's initial presentation at an Emergency Department. Conversely, records for patients admitted directly to hospital as a result of an injury contain only International Classification of Disease codes as part of the Queensland Hospital Admitted Patient Data collection (QHAPDC). Narrative descriptions are only available in the patient clinical records which are stored at each individual hospital.

This chapter outlines two studies involving an analysis of text narratives obtained from ED-based injury surveillance datasets, through text narrative review of injury description text data and an analysis of text narratives available in patient medical records. This was conducted through on-site patient chart reviews. The specific research questions for this study included:

> **RQ 7.1** What information about product types can be extracted from ED-based injury surveillance data (Study II)?
>
> **RQ 7.2** What information about product causality can be extracted from ED-based injury surveillance data (Study II) and hospital records (Study IV)?

7.2 METHODS

In this chapter, the product causality analyses were conducted using ED-based injury surveillance data as well as inpatient records data. Accordingly, the methodology is divided into two sections, the first of which documents the findings of a text narrative review of QISU data (Study III) and the second documents findings from the medical record review (study IV).

7.2.1 Text narrative review of ED-based injury surveillance data

Randomised - case selection

A secondary analysis of paediatric injury data was performed using data from the ED-based injury surveillance unit (QISU) collected between 1 January 2008 and 31 December 2010. Data obtained from the database was filtered to exclude assault, self-harm injuries and undetermined intent. However, all injury cases amongst children under the age of 12 years coded under self-harm were still included.

In total, 7,734 out of 80,440 injury cases were randomly selected using SPSS Statistics software. The 10% random selection was conducted based on the mechanism of injury codes in order to capture all possible injury mechanisms. However, smoke inhalation and biohazard injuries were excluded from the random selection due the small number of injuries within these two mechanism codes.

Table 7-1 Sampling of cases based on mechanism of injury

Mechanism of Injury	All injuries	Sample
Fall	28525	2854
Struck, hit by contact with other object, person or animal	21892	2018
Acute over - exertion of body or part of body	10262	990
Crushing, piercing	10054	942
Foreign body	3229	313
Other and unspecified mechanism of injury	2084	246
Thermal effect	2054	187
Chemical effect	1885	151
Suffocation	276	23
Electric, radiation effect	169	10
Biohazard (contact, splash, spill)	7	
Smoke inhalation	3	
Total	**80440**	**7734**

Text narrative review

The selected sample cases were reviewed manually by the PhD candidate to determine any product involvement in the injury event. The injury description text data were used as the main source of information in the text narrative review. Based on the information documented in the descriptions, the 7,734 injury cases were classified into the eight categories of Product Involvement Factors (PIF) which had previously been used in a European study, including; 1) No product involved, 2) non-manufactured product, 3) proximity product, 4) defective product, 5) maladapted product, 6) high intrinsic risk product, and 7) inadequate description (Bauer & Sector, 2000) (see Table 7-2). A set of guiding questions were used to direct the categorisation process (see Figure 7-2).

Table 7-2 –Product Involvement Factor (PIF) categories

PIF Code	**Category**	**Definition (adjusted based on QISU data)**
PIF 1	No product involved or recorded Sub-groups: - Sport related - No record of product	No product mentioned in injury description text or major injury factor
PIF 2	Product non-manufactured	Non-manufactured product (e.g. plant, animal, person)
PIF 3	Product related to proximity Sub-groups: - Stationary object - Moving object	A product involved in the accident as an intermediate object in the injury event due to its physical presence: - as a stationary object, or - as an object in appropriate use when injury are caused by other external cause
PIF 4	Product potentially defective	A product no longer functional due to a malfunction or failure during routine use or a product in need of maintenance service
PIF 5	Product potentially maladapted or misuse Sub-groups: - Maladapted (modified) - Misuse	A product purposefully used in a manner which was not its intended / normal / standard use or a product misused due to ignorance or lack of customer information on safety instructions (including misuse of adult equipment by children, self-harm and assault)
PIF 6	Product with high intrinsic risk Sub-groups based associated risk	A product known to have a high risk associated with its use including: - Risk of burn - Risk of cutting/piercing
PIF 7	Product identified but description inadequate to enable a judgment	A product involved in an injury with inadequate judgment to determine causation
PIF 8	Product under other regulation	A product that is not regulated under Product Safety regulation (e.g. motor vehicle accident)

Source: Bauer et al. (2000) (Bauer & Sector, 2000)

The definitions within each of the categories outlined in Table 7-2 (above), were slightly adjusted in this study in order to more closely align with the particulars of the Australian product safety system and the nature of Queensland injury data. The definitions, inclusions and exclusions of each category were included in Table 7-2 to minimise the degree of subjectivity in the categorisation process.

The high intrinsic risk is a relatively volatile concept which can be interpreted differently depending on other factors (e.g. age and alcohol). For example, one product can be perceived as having high intrinsic risk when used by a child but not when used by an adult. Similarly, one product can have a high intrinsic risk when used by an intoxicated person as opposed to when used by a non-intoxicated person. For this study, the high intrinsic risk category is limited to products that have naturally high intrinsic risks by themselves, and do not require other contributing factors for them to be qualified as such. In order to assist in the categorisation process, Haddon's matrix tool is used as a guide to understand the transfer of energy between the factors involved in an injury event. Products with thermal energy (burn) and mechanical energy (specifically sharp objects) risks are examples of products classified as high intrinsic risk for the purposes of this study, as such products do not require an additional contributing factor to pose a risk to consumers.

The eighth category was added to separate the products regulated by the Australian product safety regulators from those regulated by other regulators. For example – motor vehicles, food, medication and building structures are regulated separately in Australia by other specialist bodies.

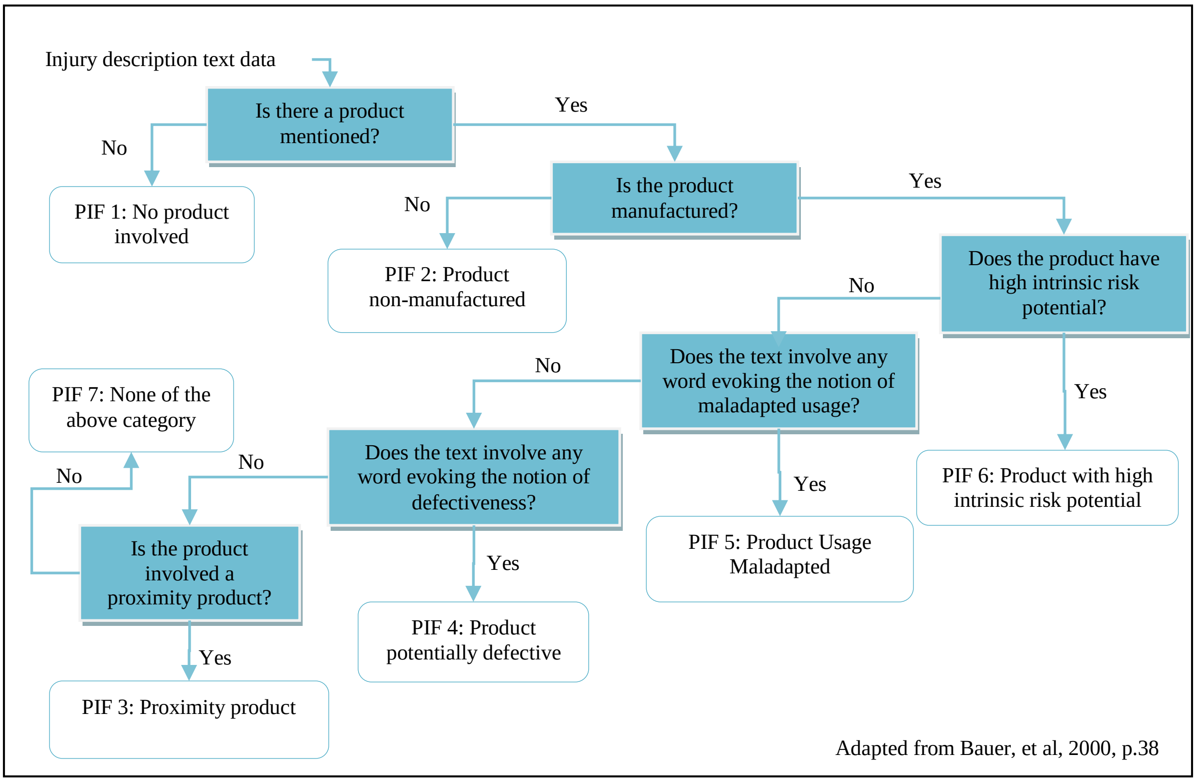


Figure 7-1 PIF application process

As highlighted in Chapter 4, the use of narrative injury descriptions to determine causality in injury cases may be associated with a degree of subjectivity. In order to reduce the subjectivity issue, a set of directive questions can be used to guide in determining product causality. The algorithm of PIF classification in Bauer and Sector's study was adopted to provide a useful model of directive questions in assigning PIF codes. However, the hierarchy of questions in assigning PIF 3, 4, 5 and 6 is subject to misclassification as more cases may be prone to be classified under Cat 3 for proximity and as the categories' inclusions can overlap. In this study, the set of questions was adjusted to address this issue. Instead of placing the most inclusive category (PIF 3 – Proximity) at the beginning of the hierarchy, the order was reversed placing the most exclusive category (PIF 6 – High intrinsic risk) in the beginning of the hierarchy.

Causality & Severity Analysis

Product causality describes a condition where a product plays an essential role in the occurrence of injury, or damage was represented within the defective (PIF 4), maladapted/misused (PIF 5) and high intrinsic risk (PIF 6) categories. In this study, product causality was quantified by computing the proportion of PIF categories 4, 5 and 6 within each mechanism of injury group. In-depth analysis to describe the patterns of PIF categories based on the demographic differences in age, gender and geographical locations were also explored.

The severity of injuries in each PIF category was analysed based on the triage category and the mode of separation. The triage categories were recoded into high, medium and low severity. The high severity category included triage category 1, resuscitation requiring immediate treatment and triage category 2, emergency cases requiring treatment within 10 minutes. The medium severity category included triage category 3, urgent cases requiring treatment within 30 minutes. Lastly, the low severity category included triage category 4 for semi-urgent cases and category 5 for non-urgent cases. The mode of separation was also used to describe severity, with the proportion of hospital admissions after emergency treatment used as the severity indicator. The number of mortality cases in each PIF category was also identified.

7.2.2 Medical Record Review

The medical record review was conducted to extract product-relevant information from patient records in hospitals. The medical record review involved onsite visits to the medical record departments to collect data from the sampled Queensland hospitals. Due to time constraints revolving around the requirement to visit the hospital sites involved in the review and to individually review patient records, the review process was limited to product-related falls and burns. This approach was taken to represent the most frequent injury mechanism (i.e. falls) and the mechanism with the highest hospital admission rate (i.e. burns) based on the previous data analysis.

The five Queensland hospitals selected for the medical record review were the Royal Children's Hospital (RCH), the Mater Children's Hospital (MCH), Logan Hospital, Gold Coast Hospital and Mackay Hospital. The selection of these hospitals was based on the preliminary analysis that showed particularly high frequencies of falls and burns in these five hospitals, therefore providing a good sample size for data collection.

Phase 1: Randomised-case selection

As part of the Public Health Act in Queensland, case selection for the medical record review can only be conducted by the Health Statistics Unit (HSU) in Queensland Health (QH). The case selection followed a process illustrated in the Figure 7-2.

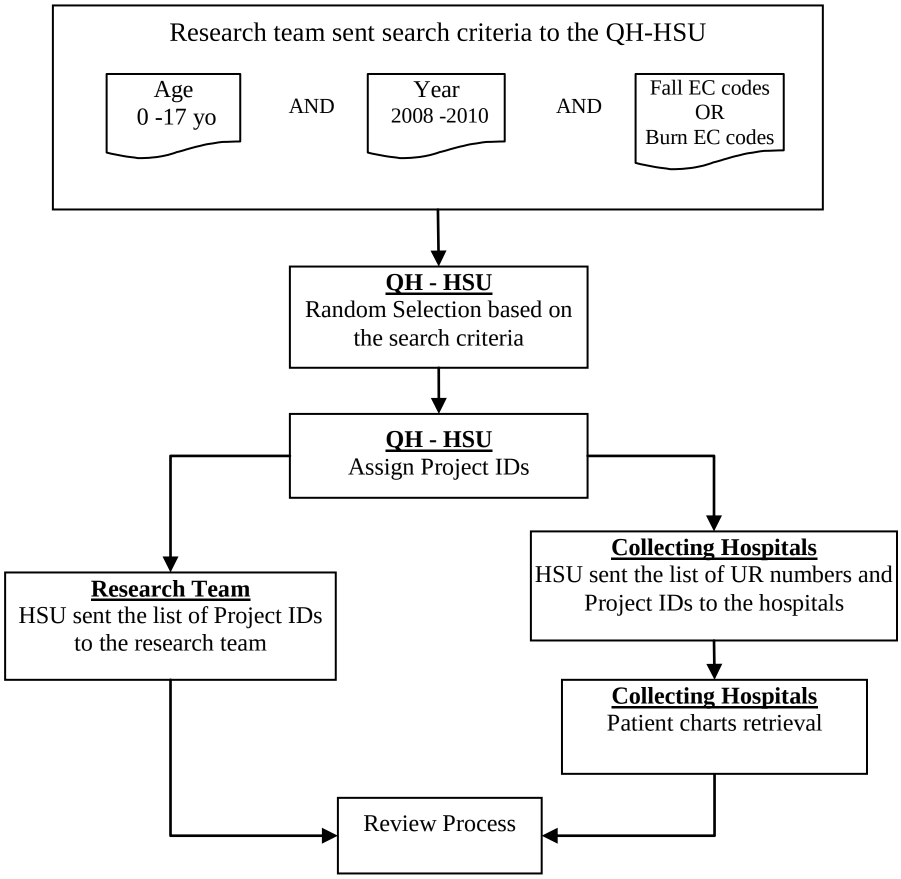


Figure 7-2 Search Criteria and Case Selection Process

The search criteria for the randomised case selection included burns and falls to children aged 0 -17 years old between 2008 and 2010. This was conducted based on the availability of burn-related external cause codes and fall-related external cause codes in records contained in the database. Only product-related external cause codes were included to eliminate non-product related injuries. The list of product-related ICD-10-AM external cause codes for burn and fall injuries is provided in the Appendix 10.

The selection criteria above were provided to the health information managers at the Queensland Health's Statistics Unit, who then randomly selected the records from the Queensland Health database for the study. All selected records were assigned project IDs and identification information was removed. The list of project IDs along with the de-identified demographic information was sent to the principal researcher. Similarly, a list of Unit Record (UR) numbers and the assigned project IDs was also sent to the health information managers at the study hospitals to assist in the retrieval of the patient records.

It was initially intended to review a total of 200 cases (100 fall and 100 burn cases) from each of the five Queensland hospitals to get a sample size with reasonable statistical power (overall intended sample size: 200 cases x 5 hospitals = 1,000 cases). However, the actual number of product-related burn cases that matched the criteria was less than the targeted number, meaning there were only 682 cases which met the overall search criteria and were selected for the study, comprising 500 falls and 182 burns.

Phase 2: Review Process

The text narrative review process involved the extraction of information from all medical record reports and forms, such as ambulance reports, emergency department forms, clinician correspondence letters, clinical notes, progress notes, discharge summaries, allied health reports, etc. for each sampled injury hospitalisation case. A data collection form developed in Microsoft Access was utilised to assist in the data collection process. The interface of the collection form is provided in the Appendix 11.

The collection form was divided into four sections to capture non-identifiable demographic, injury, product and other information. Section one focused on the demographic information along with the admission and discharge information. Several injury details were also included in the first section such as activity, type and part of place.

The second section focussed on the mechanism and nature of injury. This section allowed burn and fall cases to be interrogated differently. For burn cases, the form was designed to capture the thickness of burn and the amount of body surface burnt, while the body region was also included. In this section, secondary mechanisms prior and post the event of a burn were also included to assist in establishing the chain of injury. For falls, the form concentrated on the specific types of fall (i.e. trip, slip and fall from) along with the distance of fall. The nature of injuries, body regions as well as secondary mechanisms relating to the falls were included under this section.

The third section of the data collection form was designed to collect product-relevant information. The form included the main cause of the injury and other associated objects or products which were involved in the injury. For burn cases, a data item was designed to allow categorisation of the cause of burn such as hot liquid, hot object, electricity, chemical, etc. The type of object or product as the source of the cause was also included in the data collection form. For fall cases on the other hand, a data item was designated to capture all objects or products involved in the event of ‘tripping’, ‘slipping’, ‘falling from’ and ‘falling into’. For both fall and burn cases, any involvements of a product(s) in the injury were classified into the 8 Product Involvement Factors (PIF). A similar categorisation process as the one in the text narrative review was used in the categorisation of injury cases in the medical record review. Figure 7-1 outlines the set of questions that were used to guide the PIF categorisation. A data item that allowed collection text narratives was also included in the data collection form to summarise how the injury occurred.

Phase 3: Analysis of medical record review data

All collected data was tabulated in the Access database and exported into Excel for analysis. Similar to the data analysis in the text narrative review, the product causality describing a condition where a product played an essential role in the occurrence of injury or damage was represented in the defective (PIF 4), maladapted/misused (PIF 5) and high intrinsic risk (PIF 6) categories. Therefore, product causality was quantified by computing the proportion of PIF 4, 5 and 6 in both fall and burn cases. In-depth analysis to describe the pattern of PIF categories based on the demographic differences in age and gender were also explored.

The injury information collected in section two of the data collection form, as well as the triage category and the mode of separation from section one, were used to describe injury severity. The injury information from section two of the data collection was used to describe severity of both burn and fall injuries. In the burn cases, the burn thickness and surface area were used as indicators of severity. In the injuries resulting from falls, the nature of the injury as well as the affected body region were also used to describe the severity of injury.

In addition to the injury information, the severity of an injury was analysed based on its triage category and mode of separation. The triage categories were grouped into high, medium and low severities. The high severity category included triage category 1 – resuscitation requiring immediate treatment, and triage category 2 – emergency cases requiring treatment within 10 minutes. The medium severity category included triage category 3 – urgent cases requiring treatment within 30 minutes. Lastly, the low severity category included triage category 4 for semi urgent cases and category 5 for non-urgent cases. The mode of separation was also used to describe severity in which the proportion of hospital admissions after emergency treatment was used as the severity indicator. The number of mortality cases in both burns and falls was also identified.

An additional data item was collected to identify the specific common locations of product-relevant information in the patient records. However, the recurrence of documentation relating to product involvement in the patient charts was not collected during the medical record review, with only the first instance of a product involvement assessed. In this study, the location of product information refers to the first instance where a product involvement was detailed in the patient record based on the order of information documented upon a patient's presentation at hospital, and the subsequent treatment process. Figure 7-3 shows the common information flow in a patient episode, however, not all injury cases followed this exact order. Some injury cases were admitted through outpatient clinics, where information about the injury is often first documented on the injury proforma or in the progress notes.

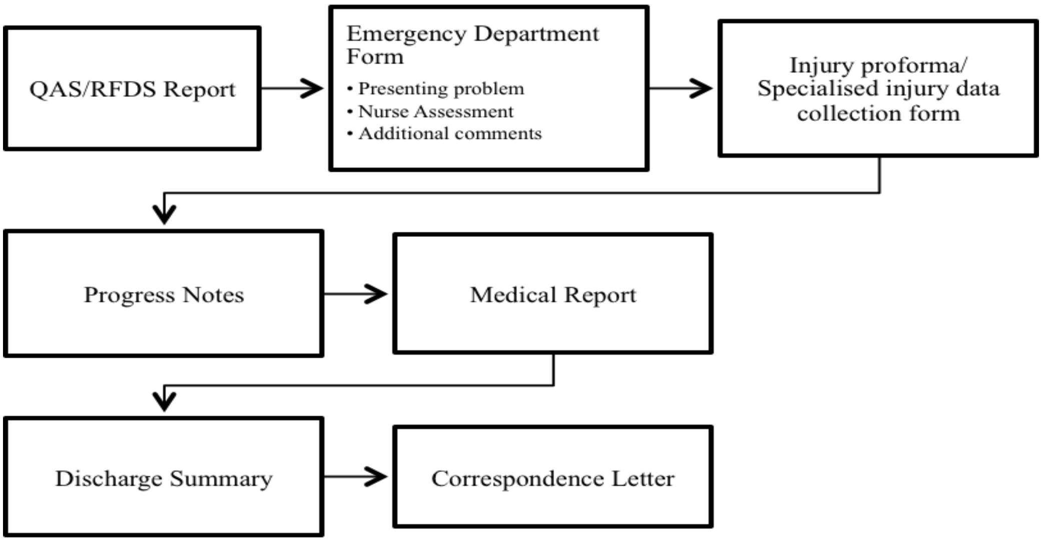


Figure 7-3 Common information flow in a patient episode

7.3 TEXT NARRATIVE REVIEW OF ED-BASED INJURY SURVEILLANCE DATA

7.3.1 Results

Sample Demographic

Out of the total of 80,440 paediatric injuries recorded in the ED-based injury surveillance database between January 2008 and December 2010, 7,734 cases (approximately 10%) were randomly selected for the text narrative review process. Demographic summaries of the sample show similar characteristics as data recorded in the overall ED-based injury surveillance database, with the largest cohort of children being 1 to 3 years old (24%) followed by children aged 10 to 12 years old (17%) and 13 to 15 years old (17%). Additionally, 61% of the sample cases were males, leaving females representing 39% of the sample.

Table 7-3 Age and gender of text narrative review sample

Age group	Gender		Total
	Male	Female	
< 1	193	163	356
1 - 3	1030	883	1913
4 - 6	683	440	1123
7 - 9	634	462	1096
10 - 12	887	547	1434
13 - 15	904	383	1287
16 - 17	364	161	525
Total	**4695**	**3039**	**7734**

Overall, the sample showed a high proportion of falls (36%) and “struck and hit by” injuries (27%). Fall injuries were predominantly sustained by children aged 1 to 3 years old, with more than a quarter of reported falls accounted for by this age group. On the other hand, “struck and hit by” injuries were more dominant in older children with the highest proportion in children aged 10 to 15 years old (42%).

Table 7-4 Mechanism of injury and age group

Mechanism of injury	Age group							Total
	< 1	1 - 3	4 - 6	7 - 9	10 - 12	13 – 15	16 - 17	
Fall	175	724	460	456	526	404	109	2854
Struck, hit by contact with object	74	409	260	282	433	405	155	2018
Acute over - exertion of body part	15	152	65	132	251	258	117	990
Crushing, piercing	28	232	184	141	143	120	94	942
Foreign body	15	134	88	29	19	19	9	313
Thermal effect	28	87	13	16	12	20	11	187
Chemical effect	3	96	10	6	9	19	8	151
Suffocation	5	13	3	2				23
Electric/radiation effect		1	1	1	1	1	5	10
Other/unspecified mechanism	13	65	39	31	40	41	17	246
Total	**356**	**1913**	**1123**	**1096**	**1434**	**1287**	**525**	**7734**

Overview

The text narrative review of injury descriptions in each of the sample cases resulted in the categorisation of product involvement in the injury event/s. Overall, 19% of the sample injuries reviewed were associated with non-manufactured products and 22% had insufficient information to identify whether an object was involved or not. Approximately 15% of injuries reviewed were under other regulations and, as a result, the product involvement among these cases was not further classified.

In total, 44% of all reviewed cases were associated with a variety of consumer products in which different types of involvements were identified. The most common involvement of a product in an injury was due to a proximity factor, with 25% of reviewed cases being categorised under this category. This comprised more than half 56% of all product-related injuries. Furthermore, approximately 13% were identified as product-related injuries; however, the type of product involvement could not be established due to inadequate descriptions of how the injury occurred.

Products as the cause of injury (causality) were likely in the three categories: defective; maladapted or misuse; and high intrinsic risk. In total, only 6% of all reviewed cases were in the product causality groups. This included approximately 4% of cases associated with high intrinsic risk products, 2% of injury cases due to products being maladapted or misused and less than 1% caused by defective products.

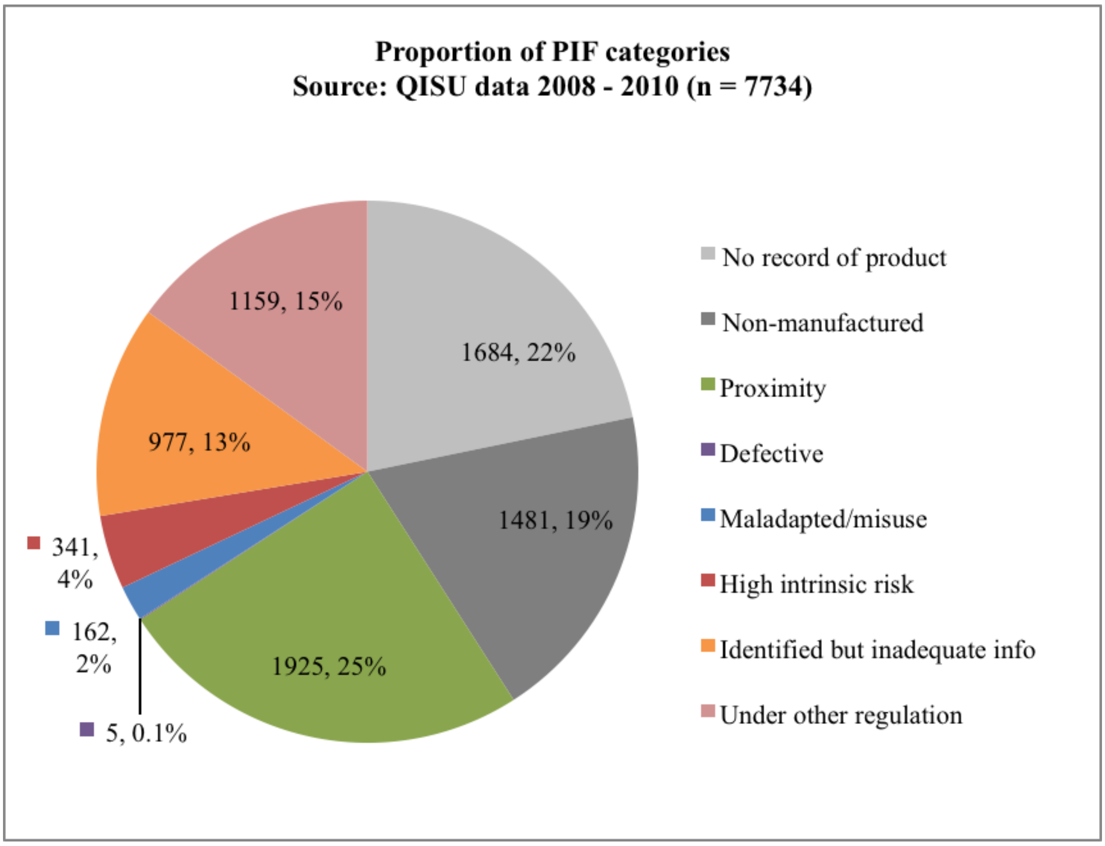


Figure 7-4 Proportion of PIF categories in ED-based injury surveillance data

Age

Further analysis to examine how the categorisation of product involvement applied in different age groups was conducted. The analysis showed a high proportion of non-manufactured products were involved in injuries amongst older age groups. Almost 30% of injuries among children aged 13-15 years were associated with non-manufactured products. In contrast, the highest proportion of product proximity involvement was amongst infants under 1 year old, accounting for 36%, and the highest proportion of injuries due to maladapted/misuse of products was amongst 1-3 year olds, accounting for 5%. High intrinsic risk products were more common in oldest age group 16-17 years old (9%).

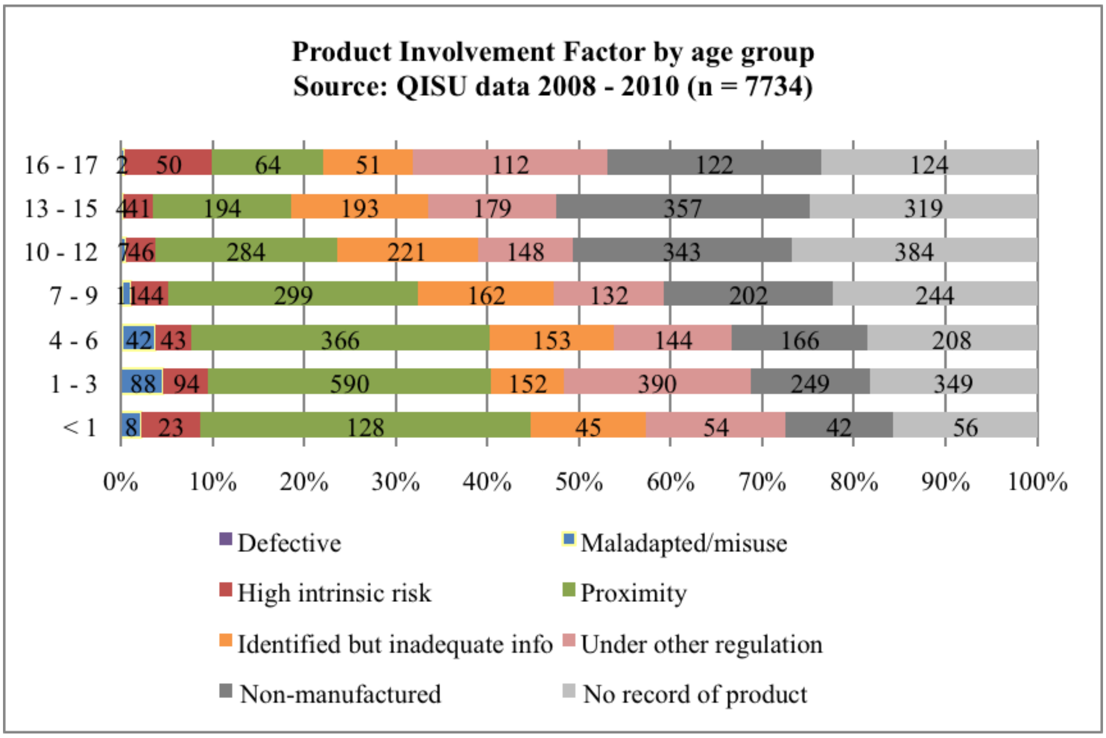


Figure 7-5 Proportion of PIF categories by age groups in ED-based injury surveillance data

Table 7-5 PIF by age group in ED-based injury surveillance data

PIF	< 1		1 - 3		4 - 6		7 - 9		10 - 12		13 - 15		16 - 17		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1. No record of product	56	16	349	18	208	19	244	22	384	27	319	25	124	24	1684	22
2. Non-manufactured	42	12	249	13	166	15	202	18	343	24	357	28	122	23	1481	19
3. Proximity	128	36	590	31	366	33	299	27	284	20	194	15	64	12	1925	25
4. Defective			1	0	1	0	2	0	1	0		0		0	5	0
5. Maladapted/Misuse	8	2	88	5	42	4	11	1	7	0	4	0	2	0	162	2
6. High intrinsic risk	23	6	94	5	43	4	44	4	46	3	41	3	50	10	341	4
7. Inadequate information	45	13	152	8	153	14	162	15	221	15	193	15	51	10	977	13
8. Other regulation	54	15	390	20	144	13	132	12	148	10	179	14	112	21	1159	15
Total	**356**	**100**	**1913**	**100**	**1123**	**100**	**1096**	**100**	**1434**	**100**	**1287**	**100**	**525**	**100**	**7734**	**100**

PIF 4 - 6: Product causality likely (the proportion of these three categories will be used as a prioritisation criteria)

Severity

The PIF categorisations also differ by the severity measures. The severity of injury was assessed based on the triage category and admission rate. Overall, approximately 7% of all injuries were classified under high severity injuries. Products under other regulatory groups tended to result in the most severe injuries as classified by their corresponding triage categories (11%). Among the consumer product-related groups, injuries associated with high intrinsic risk products were more likely to cause severe injury, with this group comprising a high proportion of severe injuries (8%). This was followed by injuries associated with maladapted/misuse of products. None of the five injuries due to defective products were classified in the high severity group.

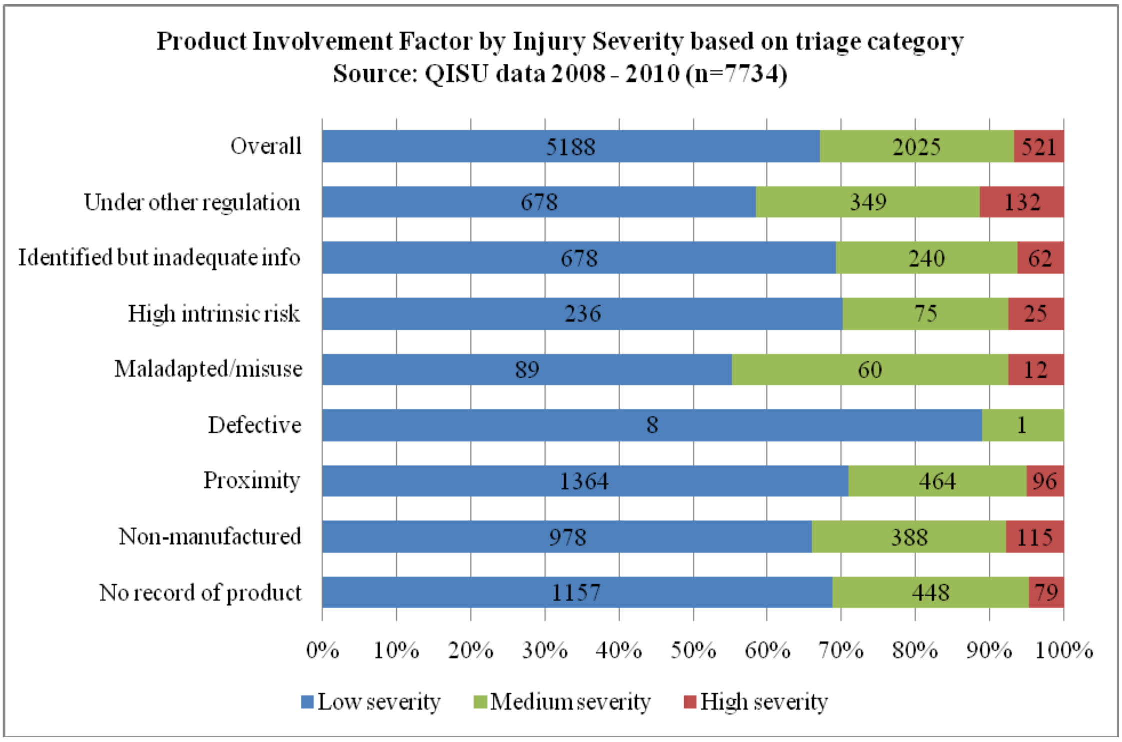


Figure 7-6 PIF proportions by triage category

Among the consumer product-related groups, injuries associated with maladapted or misused products were more prominent, with a high admission rate. Almost 20% of all injuries in this group were admitted for further treatment. This group was followed by injuries associated with high intrinsic risk products (18%). Injuries associated with defective (<1%) and proximity products (10%) were among the lowest groups in terms of their admission rate post ED presentation.

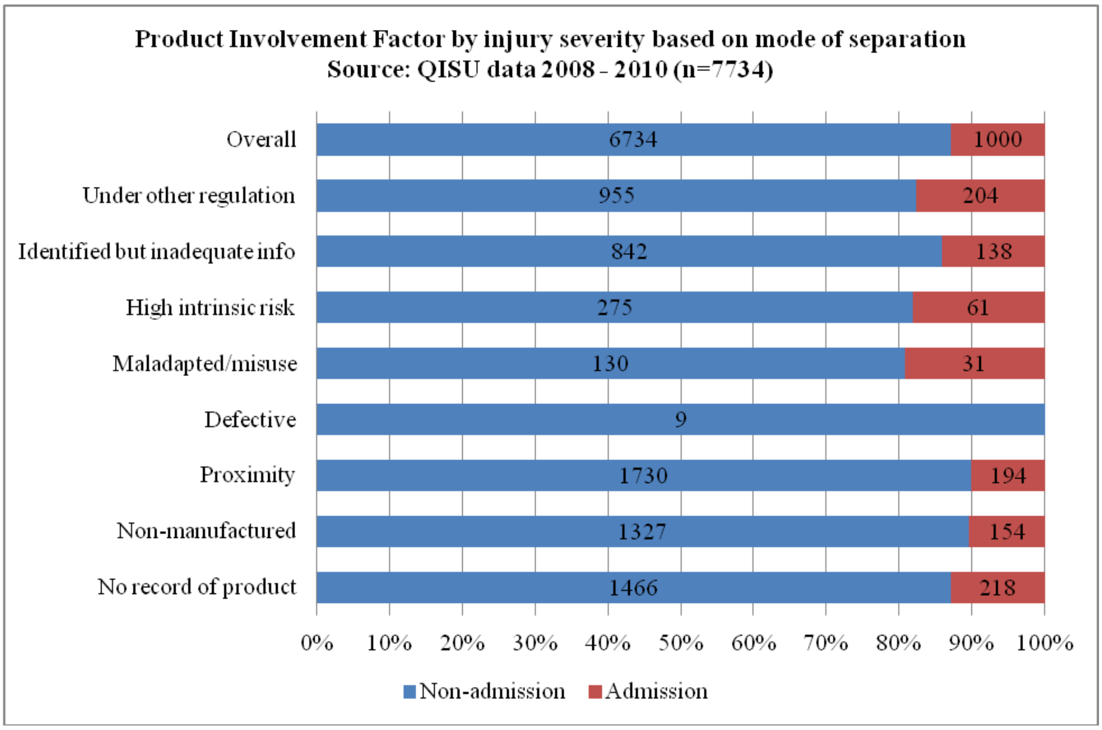


Figure 7-7 PIF proportions by admission rate in ED-based injury surveillance data

Mechanism of Injury

PIF categories were analysed based on the mechanism of injury groups. Overall, consumer products were involved in approximately 50% of fall injuries. The product involvements were mainly associated with proximity factors (32%). In approximately 18% of fall cases, the type of product involvement was not able to be established due to inadequate information. The full list of possible injury scenarios for each product type has been developed based on the text narratives in injury data obtained from the text narrative review (see Appendix 12).

Approximately 39% of injuries due to "struck, hit by" or "contact with object" classifications were related to consumer products. Similar to falls, most of these injuries were associated with proximity factors (31%). Inadequate descriptions were also encountered in approximately 6% of struck, hit by or contact injuries. High intrinsic risk products were involved in 25 cases. Furthermore, twelve struck, hit by or contact injuries were due to products which had been maladapted or misused and two injuries were due to defective products.

Acute over–exertion comprised 32% of consumer product-related injuries in which 22% were associated with proximity products and 10 were inadequately described in the text narratives to indicate the type of product involvements.

Around half (approximately 50%) of the crushing or piercing injuries were related to consumer products. High intrinsic risk products were identified in 21% of these injuries and 15% were related to proximity products. One case identified as a crushing or piercing injury was due to a defective product and seven injuries were due to maladaptation or misuse of a product. The remaining 13% of consumer product-related crushing or piercing injuries had inadequate information to determine product causality.

Foreign body related injuries comprised the highest proportion (60%) of consumer product involvements in which 28% of injuries were related to products being maladapted or misused. This is also the highest proportion of maladapted/misused cases compared to other mechanisms. Approximately 6% of foreign body injuries were related to high intrinsic risk products and 4% were related to proximity products. Regardless of being the top consumer product-related injury mechanism, the proportion of product causality in this mechanism is slightly lowered by the number of injury cases with inadequate descriptions, which accounted for 22% of all foreign body injuries. This proportion of injuries with inadequate information is the highest when compared with other mechanisms.

Product involvement in injuries due to thermal effects was identified in 54% of all the cases in this mechanism group. This significant proportion was mainly due to a large number of injuries caused by high intrinsic risk products. Almost half (47%) of thermal effect injuries were related to high intrinsic risk products. This is the highest proportion of injuries within the high intrinsic risk category when compared to other mechanisms. A small proportion of thermal effect injuries was related to proximity (3%), while defective products accounted for 1%. The proportion of injuries with inadequate descriptions was the lowest in this group, with only 3% inadequately described.

In the injuries classified under the chemical effect category, 41% were associated with consumer products. The most prominent product involvement factor in the injury events was maladaptation or misuse (26%) and only a small proportion of injuries were related to proximity factors (1%) and high intrinsic risk (3%). A defective product caused one injury case. Approximately 10% of consumer product-related injuries were in the inadequate description category.

Table 7-6 PIF by mechanism of injury (% of column/total in PIF categories)

Mechanism of injury	PIF 1 No record	PIF 2 Non-manufactured	PIF 3 Proximity	PIF 4 Defective	PIF 5 Maladapted /misuse	PIF 6 High intrinsic risk	PIF 7 Identified but inadequate	PIF 8 Under other regulation
Fall	28%	8%	32%	0.04%			18%	13%
Struck, hit by contact with object	11%	33%	31%	0.10%	1%	1%	6%	18%
Acute over - exertion of body part	29%	30%	22%				10%	9%
Crushing, piercing	10%	25%	15%	0.11%	1%	21%	13%	16%
Foreign body	22%	7%	4%		28%	6%	22%	11%
Thermal effect	33%	5%	3%		1%	47%	3%	9%
Chemical effect	1%		1%	0.66%	26%	3%	10%	59%
Suffocation	26%		9%		26%		9%	30%
Electric, radiation effect	30%	30%				40%		
Other and unspecified mechanism	59%	9%	7%		2%	1%	8%	13%
Total	**22%**	**19%**	**25%**	0.06%	**2%**	**4%**	**13%**	**15%**

The product causality in each mechanism of injury group was quantified based on the proportion of PIF 4, 5 and 6 and then ranked from the highest proportion to the lowest. Overall, the results show that thermal effect injuries were the first in the rank with almost half (88/187, 47%) of thermal effect injuries caused by consumer products. This was followed by foreign body injuries with 34% (106/313) of injuries caused by consumer products. In the third and fourth ranks were crushing or piercing 29% (44/151) and struck, hit by, contact with object injuries 22% (203/942). The product causality was significantly low in fall and acute over-exertion injuries, with the proportion of product causality of less than 1% in each of these mechanism groups.

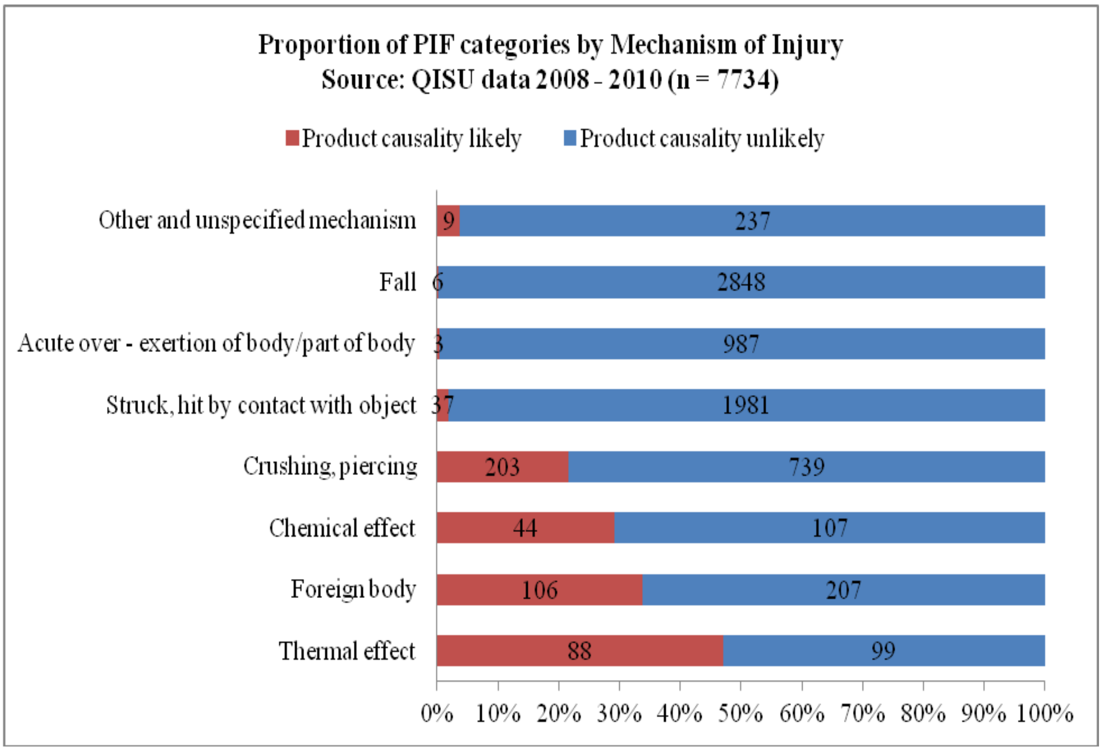


Figure 7-8 PIF proportions by mechanism of injury in ED-based injury surveillance data

Injuries related to defective products

In total, five injury cases were classified under the defective product category during the text narrative review process. Two seven year old males were injured by hits from defective products. One was hit by a broken yoyo when a ball bearing from within the object bounced into the child's ear, while the other was injured by a falling basketball hoop when it hit his head. Also included in this category, a ten year old male child fell from a swing after the support rope broke and a six year old male was injured after the chemical release from a glow stick entered his eye after the object snapped while the child was playing with it. Lastly, a one year old female toddler sustained an open wound on her scalp due to falling metal blinds. The number and proportion of defective products identified in this review may be underestimated due to the large number of cases being inadequately described in the injury data.

Injuries related to maladapted or misused products

In total, 162 cases were classified under maladaptation or misuse of products. Foreign body injuries were the most dominant mechanism of injury in this category, comprising 34% (88/162) of all maladapted or misuse related injuries. These injuries were mostly sustained by children under the age of 7 years old (89%, 78/88). Coins were the most common product misused by children causing foreign body injuries. Chemical effect injuries were the second most common mechanism of injury under this category accounting for 24% (39/162) of all injuries due to maladapted/misused products. Approximately 85% of injuries due to misuse of chemical products were related to household chemicals. Children aged between 1 – 3 years were the most vulnerable age group to chemical injuries.

Table 7-7 Misuse of product injuries based on mechanism of injury & type of product

Mechanism of injury & Type of product	**Age group**							**Total**
	< 1	**1 – 3**	**4 – 6**	**7 – 9**	**10 – 12**	**13 – 15**	**16 – 17**	
Foreign body	3	39	35	6	3	1	1	88
Chemical effect		32	2	1	2	2		39
Struck, hit by contact with object	1	7	1	2	1			12
Crushing, piercing		4	1		1		1	7
Suffocation	1	3	1	1				6
Other and unspecified mechanism	2	3	1					6
Fall	1		1			1		3
Thermal effect				1				1
Total	**8**	**88**	**42**	**11**	**7**	**4**	**2**	**162**

Injuries related to high intrinsic risk products

In the text narrative review process, high intrinsic risk products were found in 339 injury cases. Crushing or piercing injuries were the most common injury in this category, comprising 58% (195/339) of all high intrinsic risk injuries. As shown in Table 7-8, the distribution of crushing or piercing injuries in this category was relatively even in all age groups with a slight increase in older children aged 10 to 17 years. Knives were the most common products causing piercing injuries (55/195), followed by kitchen utensils (27/195). The second most common mechanism of injury under the high intrinsic risk product category was thermal effect injuries. Approximately, 26% of injuries in this category were caused by thermal effect in which most of the injuries were sustained by younger children under 4 years old (61/87, 70%). Cooking appliances (33/87, 38%) and hot beverages (22/87, 25%) were the two most common products causing burn injuries in this category.

Table 7-8 High intrinsic risk injuries by mechanism of injury & type of product

Mechanism of injury & Type of product	**Age groups**							**Total**
	< 1	**1 - 3**	**4 - 6**	**7 - 9**	**10 - 12**	**13 - 15**	**16 - 17**	
Crushing, piercing	5	33	29	29	35	30	34	195
Thermal effect	13	48	8	6	4	4	4	87
Struck, hit by contact with object	3	6	2	5	1	3	3	23
Foreign body	2	4	2	1	4	3	2	18
Chemical effect		2	1			1		4
Electric, radiation effect			1				3	4
Acute over - exertion of body/body part					1		2	3
Other and unspecified mechanism				1	1		1	3
Fall				1			1	2
Total	**23**	**93**	**43**	**43**	**46**	**41**	**50**	**339**

Injuries related to proximity products

In total, 1922 injury cases were classified under the proximity-related injury category. These injuries comprised more than half (1922/3410, 56%) of all product related injuries that were identified in the text narrative review process. Even though a large number of product-related injuries were identified as proximity injuries, this category was not included as part of the product causality indicator.

Injuries from falls were the most dominant mechanism of injury in this category, comprising 47% (910/1923) of all proximity product-related injuries. These injuries were mostly sustained by younger children under the age of 10 years old with a peak in the 1 – 3 years old group (37%, 338/910). Falls were followed by injuries due to being struck by, hit by or in contact with object accounting for 32%

(618/1923). Children aged 1 – 3 years were also the most prominent age group (%, 165/618) in this injury mechanism group. Furniture products were the most common product group that was associated with the product-related falls (%, 346/910) as well as the injuries due to being struck by, hit by or in contact with object (% 198/618). Fall injuries in the proximity category also include a large number of falls from playground equipment, accounting for 25% (229/910) of all falls. Sporting equipment was the second most common product group causing injuries from the struck by, hit by and contact mechanism.

Table 7-9 Proximity injuries based on mechanism of injury & type of product

Mechanism of injury & Type of product	**Age groups**							**Total**
	< 1	**1 - 3**	**4 - 6**	**7 - 9**	**10 - 12**	**13 - 15**	**16 - 17**	
Fall	85	338	196	135	95	51	10	910
Struck, hit by contact with object	28	165	109	96	117	79	24	618
Acute over - exertion of body	5	28	18	38	59	48	19	215
Crushing, piercing	5	42	34	26	11	13	8	139
Other and unspecified mechanism		7	4	1	2	1	3	18
Foreign body	1	4	4	2		2		13
Thermal effect	1	3	1	1				6
Suffocation		2						2
Chemical effect		1						1
Total	**125**	**590**	**366**	**299**	**284**	**194**	**64**	**1922**

Injuries related to inadequate information

In total, 980 injury cases were identified as product-related injuries; however, the injury descriptions in the data were insufficient to suggest the type of product involved. There were a significant proportion of injuries with inadequate descriptions in the data, with almost 30% of all product-related injuries included in this category. Bicycles, trampolines, scooters and skateboards were the top five products that were commonly associated with injuries under this category. Bicycle-related injuries were most common in children aged 10 – 15 years, whereas trampoline-related injuries were most common in younger children aged 1 – 9 years. Scooter-related injuries were most common in children aged 10 – 12 years whereas skateboard-related injuries were most common in children aged 13 – 15 years.

Table 7-10 Product-related injuries with inadequate information to establish product involvement

Type of product	Age groups							Total
	< 1	1 - 3	4 - 6	7 – 9	10 - 12	13 - 15	16 - 17	
Bicycle		17	37	46	86	72	20	278
Trampoline		35	42	36	30	15	3	161
Scooter		6	22	29	46	28		131
Skateboard	1	1	2	15	32	43	4	98
Kitchen utensil		6	4	9	4	8	4	35
Children/baby product	20	10	3	1				34
Metal		4	3	7	2	7	10	33
Splinter	2	6	8	5	4	4	3	32
Jewellery (inc bead)		12	12	3	2	1	2	32
Children/baby furniture	20	9	1					30
Children's toy		9	4	2	1	1		17
Household chemical		7	1	1	3	3		15
Sporting equipment		2	2		2	2	2	10
Furniture	1	3	3			3		10
Pen/pencil		5	2		1	1		9
Playground Equipment		3		3	1			7
Other appliance		2			1	1		4
Rip stick					2			2
Petrol				1				1
Pesticide		1						1
Trolley				1				1
Power tool		1						1
Pool			1					1
Heating appliance							1	1
Other	4	13	6	3	4	4	2	36
Total	**48**	**152**	**153**	**162**	**221**	**193**	**51**	**980**

7.3.2 Discussion

The findings from the text narrative review indicate that text narrative data plays a significant role in identifying the types of products (RQ 7.1) involved in injury cases and are also pivotal in establishing product causality (RQ 7.2). The types of objects involved in the injuries were able to be retrieved from the text narrative data in almost 80% of all injury cases evaluated in the text narrative review. Types of products under other regulations in Australia and non-manufactured objects were also able to be separated from a range of consumer products during the PIF categorisation process. This is consistent with the findings from Jones and Lyons's study in which text narrative data was found to reduce the proportion of unknown cases (Jones & Lyons, 2003). The results in this study also confirmed the findings from Bauer and Sector's study that found that a PIF categorisation tool is useful to identify product-related cases in injury data (Bauer & Sector, 2000).

The product causality which describes the circumstances where a product plays an essential role in the occurrence of injury or damage, was represented in the defective (PIF 4), maladapted/misused (PIF 5) and high intrinsic risk (PIF 6) categories. The quantification of product causality based on the proportion of PIF, 4, 5 and 6 allowed the mechanisms of injury to be ranked. This finding can be used in addition to the frequency and severity findings in the previous chapters to construct a method to prioritise product safety issues. Overall, 44% of all reviewed cases were associated with a variety of consumer products in which different types of involvements were identified. However, only 6% were established as product causality likely. This rate is slightly higher than the percentage of the same category reported by the European study, demonstrating 5% of product causality likely (Bauer & Sector, 2000).

The majority of product-related injuries were related to proximity factors (25%), but 13% were inadequately described to establish product causality judgement. The lack of information in the injury descriptions can possibly be explained by the commonness and regularity of several injury types. For example, falls from bicycles and trampolines which comprised the highest proportion of injuries in the inadequate description category were also the most frequent injury presentations in the emergency departments; therefore how these injuries occurred may have been regarded as evident and clear documentation not necessary.

The exclusion of proximity and inadequate description categories from product causality indicators may have impacts in the prioritisation of product safety issues. Hence, products such as furniture (which was the most common proximity product), bicycles, trampolines, skateboards, scooters and other hazardous products may be missed by the product safety prioritisation. In order to improve the prioritisation process, this limitation can be addressed by considering the common injuries as high intrinsic risk. Bicycles, scooters, skateboards and trampolines, for example, are known to impose high risks of falling amongst children. Therefore, injuries related to these products can be classified as high intrinsic risk.

The text narrative review in this study has several limitations. Firstly, the results depend significantly on the accuracy and completeness of the text data. Text narratives reviewed for this study were collected at the point of triage in the emergency department. The urgency of treatment may have contributed to the accuracy and completeness of the information in the text narrative data. Moreover, the text descriptions were manually reviewed and categorised based on the PIF categories by only one coder. Therefore, subjectivity in the categorisation process may also be a factor.

The completeness of text narrative data in ED-based injury surveillance data may be different in different states due to varying level of detail in each injury data collection. The text narrative data from the Queensland ED-based injury surveillance unit (used in this study), for example, may be more detailed compared to the ED-based injury surveillance data from Victoria as Queensland data are collected using the NDS-IS level 2.

7.4 MEDICAL RECORDS REVIEW

7.4.1 Results

Sample Demographic

Overall, out of the 682 cases randomly selected by the Queensland Health Statistics Unit (HSU), 653 injury cases were reviewed in five Queensland hospitals. A total of twenty medical records were not able to be retrieved and six cases were duplicates from multiple episodes of care relating to the same injury incident. During the review, a total of 46 non-product related injuries were eliminated from the data analysis leaving a total of 611 related cases.

Table 7-11 Sample demographic of medical record review cases

		Fall N(%)	**Burn N(%)**	**Total Sample N(%)**
		455(74)	156(26)	611(100)
Gender	Male	275(60)	100(64)	375(61)
	Female	180(40)	56(36)	236(39)
Age	< 1	34	24	58
	1 - 3	101	82	183
	4 - 6	97	8	105
	7 - 9	104	11	115
	10 - 12	68	12	80
	13 - 15	39	9	48
	16 - 17	12	10	22
Length of stay	Mean	1.97	2.17	2.02
	Max	19	19	19
	Median			
Admission source	ED	438(96)	126 (81)	571(92)
	OPD	15(3)	27(17)	42(7)
	Other	3(1)	3(2)	6(1)
Mode of separation	Died in hospital	1 (0.1)		1(0)
	Home	429 (94)	126 (81)	555 (91)
	Transferred	9 (2)	16 (10)	25 (4)
	Episode change	5 (1)	11 (7)	16 (3)
	Other/unspecified	11 (2)	3 (2)	14 (2)

Demographic summaries of the sample injury cases shown in Table 7-11 indicate a peak in age group 1 to 3 years old (30%), followed by older children aged 7 to 9 years old (19%). The number of fall-related injuries was elevated across children aged 1 – 9 years (66% of all falls) whereas the number of burn-related injuries was more concentrated in those aged 1 – 3 years old (53%). These sample data convey similar age patterns as the fall and burn injuries in the hospital admission data in section 5.3.2. In the hospital admission data, fall injuries were also prominent across 1 – 9 year olds (67% of all falls) with a peak in 4 – 6 year olds (25% of all falls) while burn (thermal effect) injuries were prominent in 1 – 3 year olds (48% of all burns).

The average length of stay for all the sample cases was 2.02 days, with the average for burn cases (2.17) slightly higher than the average for fall cases (1.97). This reflects similar patterns in the ALOS for fall and burn injuries in the hospital admission data as presented in section 6.3.2. Burn (thermal effect) injuries showed higher ALOS (2.43) compared to falls (1.29). The majority of sample cases were admitted to the hospital through the emergency department. Approximately 92% were admitted through an ED while the remaining cases were admitted through outpatient clinics. Out of all the cases reviewed, only one mortality case was identified amongst the fall-related cases. The majority of cases were discharged and allowed to return home after hospital treatment. Transfer of patients was more likely amongst the burn cases with 10% of all burn cases transferred to another hospital.

7.4.2 Fall-related injuries

Age & Gender

Overall, 455 falls were analysed in this study, with the majority of cases being males (60%). As shown in the Figure 7 - 9, the number of falls increased from 1 year old through to 9 years old and dropped significantly at the age of 10 years old. The increase at 1 year old was slightly more prominent in males (increased 4 times) than females (increased 2 times). Meanwhile, the reduction of injuries at 10 years old was more prominent in females (decreased by more than half) than males (decreased by 12%).

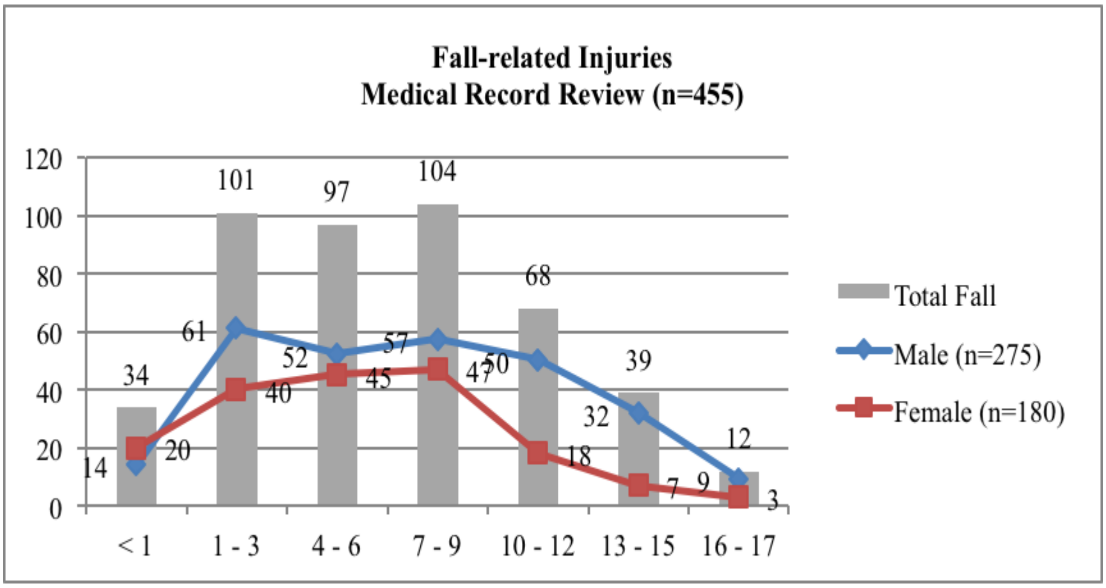


Figure 7-9 Age and gender of medical record review cases

Product Involvement Factor

In the medical record review study, product involvement in falls was categorised based on the PIF categories. Overall, 64% of the fall cases reviewed were associated with proximity products and 31% had insufficient information to identify the type of product involvement in the injury event. Products as the cause of injury (causality) were likely in the three categories: defective, maladapted or misuse and high intrinsic risk. In total, approximately 5% of all reviewed cases were in the product causality groups. This included 4% of cases associated with misuse of products, while 1% of injury cases were caused by defective products and less than 1% were caused by high intrinsic risk products.

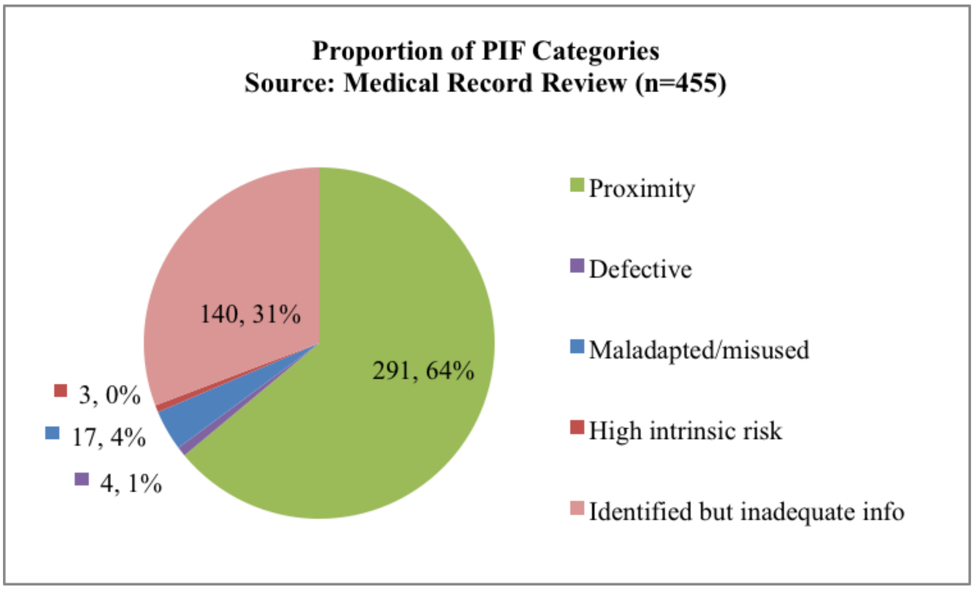


Figure 7-10 Proportion of PIF categories in fall-related injuries

The proportion of PIF categories was analysed across age groups. Injuries related to proximity products were more prominent in children aged 1 – 6 years, with a peak at 1 – 3 years old. Misuse of products was identified in younger children with a peak at 1 – 3 years old. One injury case due to a defective product was sustained by an infant under 1 year old. The remaining defective products were identified in 3 injuries sustained by 4, 5 and 8 year old children. The three high intrinsic risk cases were identified in older age groups, in injuries sustained by two 12 year old children and one 14 year old child.

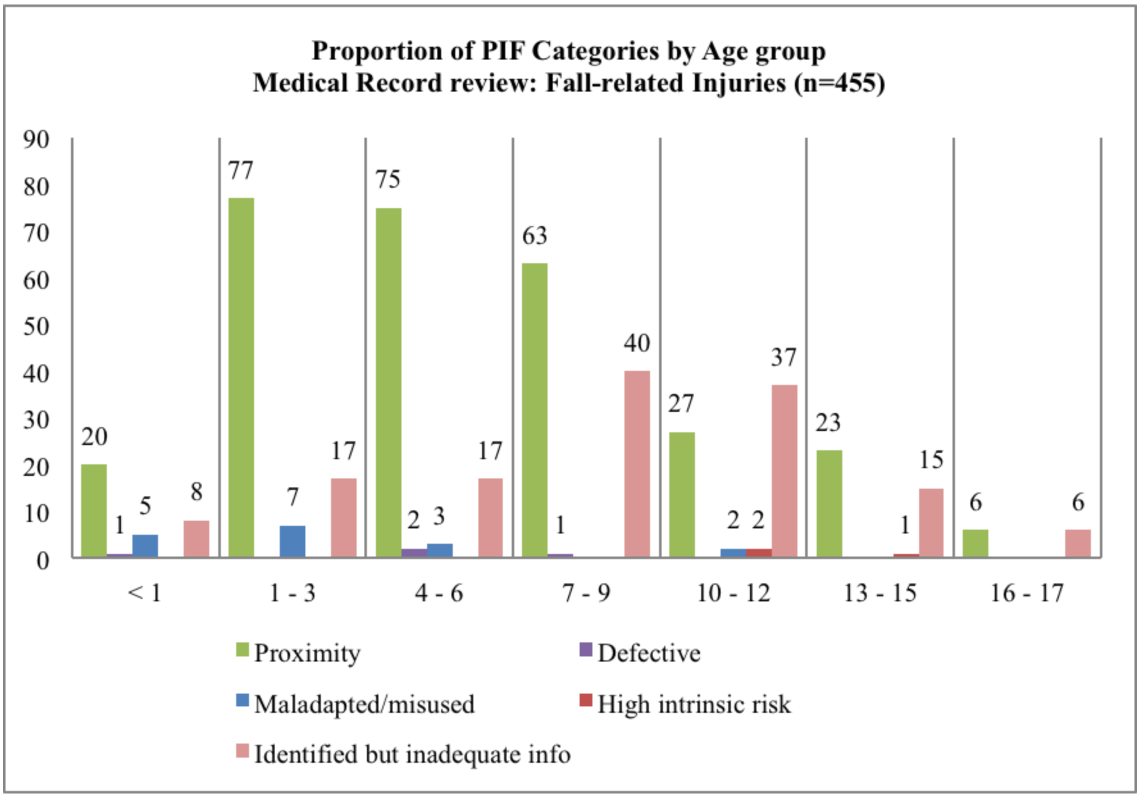


Figure 7-11 Proportion of PIF categories in fall-related injuries based on age

PIF categories were analysed based on the nature of injury groups and body region injured. As shown in Table 7-12, the comparison of the proportion of proximity injuries in the nature of injury groups showed open wound injuries comprised the highest proportion of proximity injuries compared to other nature of injury, which accounted for 80% of all open wound injuries. This was followed by superficial injuries (69%) and fracture injuries (65%). Defective products resulted in one fracture of the upper extremity, two head injuries and one dislocation of a lower extremity. High intrinsic risk products resulted in three fracture injuries, including two cases of upper extremity fractures and one case of lower extremity fracture. Maladapted or misused products were found in almost all nature of injury groups including fractures (3 cases), superficial injuries (4 cases), open wounds (2 cases), head injuries (2 cases) and multiple injuries (1 case).

Table 7-12 PIF categories based on body region & nature of injury in fall-related injuries

Body region & Nature of Injury	PIF Categories (% of row total)										Total
	Proximity		Defective		Maladapted/ misused		High intrinsic risk		Inadequate description		
	n	%	n	%	n	%	n	%	n	%	n
Fracture	**183**	**65%**	**1**	**0%**	**3**	**1%**	**3**	**1%**	**93**	**33%**	**283**
Upper extremities	160	66%	1	0%	2	1%	2	1%	77	32%	242
Lower extremities	16	59%		0%		0%	1	4%	10	37%	27
Head & neck (inc. face)	6	46%		0%	1	8%		0%	6	46%	13
Torso	1	100%		0%		0%		0%		0%	1
Superficial	**38**	**69%**		**0%**	**4**	**7%**		**0%**	**13**	**24%**	**55**
Head & neck (inc. face)	36	75%		0%	4	8%		0%	8	17%	48
Torso	2	50%		0%		0%		0%	2	50%	4
Lower extremities		0%		0%		0%		0%	2	100%	2
Upper extremities		0%		0%		0%		0%	1	100%	1
Open wound	**37**	**80%**		**0%**	**2**	**4%**		**0%**	**7**	**15%**	**46**
Head & neck (inc. face)	35	83%		0%	2	5%		0%	5	12%	42
Lower extremities	2	50%		0%		0%		0%	2	50%	4
Concussion/head injury	**16**	**59%**	**2**	**7%**	**2**	**7%**		**0%**	**7**	**26%**	**27**
Head & neck (inc. face)	16	59%	2	7%	2	7%		0%	7	26%	27
Dislocation/sprain	**6**	**35%**	**1**	**6%**		**0%**		**0%**	**10**	**59%**	**17**
Upper extremities	6	43%		0%		0%		0%	8	57%	14
Lower extremities		0%	1	50%		0%		0%	1	50%	2
Head & neck (inc. face)		0%		0%		0%		0%	1	100%	1
Multiple	**2**	**50%**		**0%**	**1**	**25%**		**0%**	**1**	**25%**	**4**
Head & neck (inc. face)	1	33%		0%	1	33%		0%	1	33%	3
Multiple bodily location	1	100%		0%		0%		0%		0%	1
No abnormality detected	**9**	**39%**		**0%**	**5**	**22%**		**0%**	**9**	**39%**	**23**
Total	**291**	**64%**	**4**	**1%**	**17**	**4%**	**3**	**1%**	**140**	**31%**	**455**

The types of products causing falls are listed in Table 7-13. Trampolines are the most common specific type of product identified in all fall cases reviewed. Trampoline-related injuries accounted for 16% of all fall-related injuries. Other products were grouped in product categories. Playground equipment was identified in 110 fall cases, in which monkey bars accounted half of all playground equipment injuries. Furniture products were the second most common product group identified in all the fall cases.

The majority of proximity-related product injuries were accounted for by playground equipment (109 cases) and furniture products (93 cases). Seventeen injuries were identified as misuse of products. Seven injuries related to babies' furniture, two injuries related to prams and one injury related to a shopping trolley were regarded as being misused because the child was not strapped in when using the products. Similarly, two trampoline cases were classified as misuse of product due to the safety net's zip being undone. The swing (jumping backwards from a swing) and the ball (standing on a ball) related injuries were regarded as misuse as they were being used in a dangerous manner.

The four injuries due to defective products were identified as one hammock injury, two trampoline injuries and one "Jolly Jumper" injury. The three high intrinsic risk injuries included two ice skating injuries and a "RipStick" injury. The full list of possible injury scenarios for each product type has been developed based on the injury descriptions obtained from the medical record review (see Appendix 12).

Table 7-13 PIF categories in fall-related injuries based on product types

Product types	**PIF Categories (% of row total)**					**Total**
	Proximity	**Defective**	**Misused**	**High intrinsic risk**	**Inadequate description**	
Playground equipment	**109**		**1**			**110**
Monkey bars	55					55
Swing	16		1			17
Playground equipment	13					13
Slide	12					12
Flying fox	8					8
Water slide	2					2
Jumping castle	1					1
Balance beam	1					1
Pole	1					1
Furniture	**93**	**1**				**94**
Bed	20					20
Chair	18					18
Bunk bed	16					16
Couch	14					14
Mat/carpet	6					6
Stool	4					4
Coffee table	4					4
Table	3					3
Hammock	2	1				3
Cupboard	3					3
Massage table	1					1
Entertainment Unit	1					1
Mattress	1					1
Trampoline	**17**	**2**	**2**		**51**	**72**

Product types	PIF Categories (% of row total)					Total
	Proximity	Defective	Misused	High intrinsic risk	Inadequate description	
Skateboard	**9**				**34**	**43**
Scooter	**10**				**29**	**39**
Baby/children furniture	**9**	**1**	**7**		**5**	**22**
Change table	1		3		3	7
Cot	6					6
Baby capsule			3			3
High chair			1		2	3
Baby sling	1					1
Playpen	1					1
Jolly jumper		1				1
Shopping trolley	2		4		4	10
Sporting equipment	8		1			9
Rip stick/ Rollerblade	2			1	7	12
Pram/stroller			2		3	5
Other (Toy, Ladder, Push bike, Shoelace, Gym equipment, Ice skate, Power cord, Hose, Glass)	18			2	2	22
Total	**279**	**4**	**17**	**3**	**135**	**438***

* Conflicting types of product in 12 cases

The PIF categories were analysed based on the length of stay in the hospital and the type of hospital stay. As shown in Table 7-14, injuries due to defective products exhibited the longest ALOS (2.25 days), while injuries due to misuse of products exhibited the shortest ALOS (1.53 days). The proportion of overnight stays was also highest in injuries due to defective products, while the lowest proportion of overnight hospital stays was amongst the injuries due to high intrinsic risk products.

Table 7-14 Length of stay of fall-related injuries based on PIF categories

PIF Categories	Length of Stay					Total
	ALOS	Overnight		Sameday		
		n	%	n	%	
Proximity	1.95	169	58%	122	42%	291
Defective	2.25	3	75%	1	25%	4
Maladapted/misused	1.53	6	35%	11	65%	17
High intrinsic risk	1.67	1	33%	2	67%	3
Inadequate description	2.09	89	64%	51	36%	140
Total	**1.98**	**268**	**59%**	**187**	**41%**	**455**

Triage categories were tabulated based on the PIF categories as shown in Table 7-15. In contrast to the results above, which were based on length of stay, the triage categorisation showed that the highest proportion of high severity injuries (24%) was for injuries due to the misuse of products. The proximity injuries comprised 18% of high severity injuries, 31% of medium severity injuries and 49% of low severity injuries. Injuries due to defective products were classified as medium severity (2 cases) and low severity (2 cases), whereas injuries due to high intrinsic risks were classified under medium severity (3 cases).

Table 7-15 Triage categories of fall-related injuries based on PIF categories

PIF Categories	**Triage Categories**								**Total**
	High Severity		**Medium Severity**		**Low Severity**		**Unspecified**		
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Proximity	50	18%	89	31%	139	49%	5	2%	283
Defective			2	50%	2	50%			4
Maladapted/misused	4	24%	6	35%	6	35%	1	6%	17
High intrinsic risk			3	100%					3
Inadequate description	27	21%	40	31%	62	47%	2	2%	131
Total	**81**	**18%**	**140**	**32%**	**209**	**48%**	**8**	**2%**	**438**

Documentation of Product Information

The documentation of product information in the medical records was analysed based on the type of information and the location in the record. Overall, in more than half of all fall cases reviewed (55%), product involvement in the injury event was documented in the presenting problem section on the ED form. In approximately 24% of all fall cases, product involvement was identified in the additional comments section of the ED form. Product involvement was also documented in Queensland Ambulance Service (QAS) reports, progress notes, nursing assessments, injury proformas, discharge summaries and correspondence letters. Six cases were identified with conflicting information, where different types of products were mentioned in different locations in the medical records.

Out of the 455 cases reviewed, approximately 7% (34/455) of medical records documented the involvement of secondary objects. This information was commonly documented as additional comments on the ED form. Protective equipment information was documented in 5% (23/455) of all fall cases, which included 8 cases of failed equipment, 13 cases did not include use of protective equipment and 2 cases did use protective equipment. Approximately, 7% (32/455) of all fall cases included additional information about the product such as brand, multiple users, part of product causing the injury and specific type of product.

Table 7-16 Documentation of product information in fall-related injuries

Location in Medical Record (Ordered based on order in medical record)	**Product Information (% of total n = 455)**							
	Main object		**Second object**		**Additional info**		**Protective Equipment**	
	n	**%**	**n**	**%***	**n**	**%***	**n**	**%**
QAS Report	28	6%	5	1%	4	1%	3	1%
RFDS Report	1	0%						
Presenting problem (ED form)	252	55%	9	2%	6	1%	5	1%
Nursing Assessment Data (ED form)	9	2%						
Injury proforma	6	1%	3	1%	3	1%	2	2%
Additional Comments (ED form)	109	24%	13	3%	13	3%	10	0%
Progress notes	28	6%	3	1%	2	0%		
Medical report	1	0%					1	0%
Discharge Summary	6	1%	1	0%			1	0%
Correspondence Letter	9	2%			3	1%		
Transport service					1	0%	1	0%
- *Conflicting product type*	6	1%						
Total	**455**	**100%**	**34**	**7%**	**32**	**7%**	**23**	**5%**

7.4.3 Burn-related injuries

Age & Gender

Overall, 156 injuries arising from burns were analysed in this study, with the majority of cases being males (64%). As shown in the Figure 7-12, children aged 1 – 3 years comprised a large proportion of all the burn cases reviewed in the study, with more than half of all burns sustained by children in this age group. Furthermore, infants under 1 year old also comprised a significant proportion of all burn cases with a proportion of 15%.

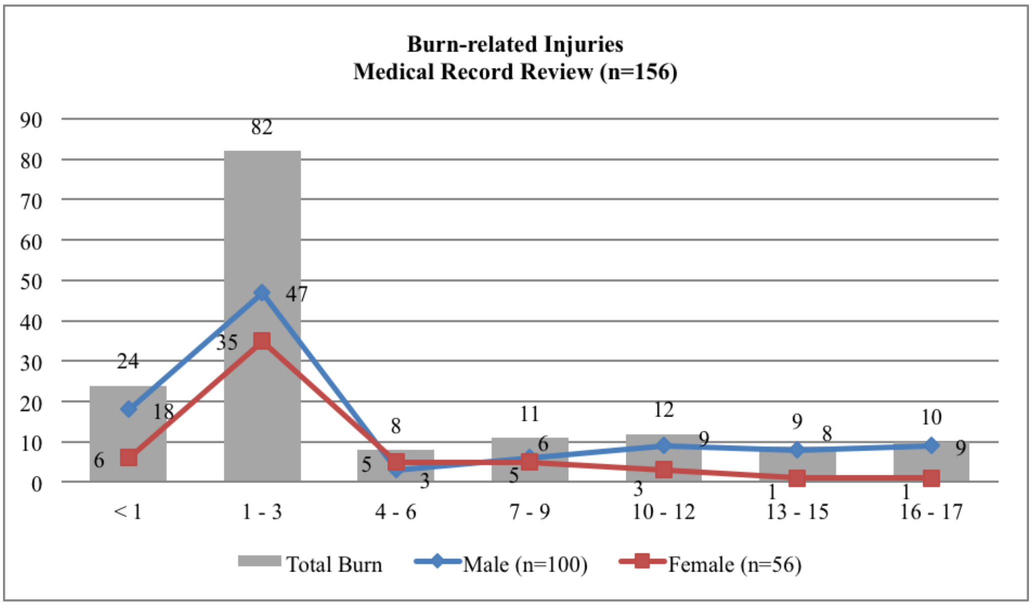


Figure 7-12 Age & gender of burn-related injuries

Type of burn

The results of the medical record review showed that the majority of burn-related injuries were associated with partial thickness burns. As shown in Table 7-17, partial thickness burns accounted for more than half (54%, 84/156) of all burn cases. Erythema and full thickness burns accounted for equal proportions, with each category comprising 19% of all burn cases.

Burns to the upper extremities comprised the highest proportion (44%, 69/156) of all burn cases compared to other body regions. Amongst the upper extremity injuries, partial thickness burns accounted for 48% of all upper extremity burns. Furthermore, approximately 29% of all upper extremity burns resulted in full thickness burns. This is also the highest proportion of full thickness injuries compared to the proportions of the same burn thickness in other body regions.

Table 7-17 Burn thickness of burn injuries based on body region

Body region	Burn thickness (% of row total)								Total
	Erythema		Partial		Full		Unspecified		
	n	%	n	%	n	%	n	%	
Upper extremities	10	14%	33	48%	20	29%	6	9%	69
Lower extremities	5	14%	20	57%	7	20%	3	9%	35
Multiple bodily location	8	24%	21	64%	3	9%	1	3%	33
Torso	3	27%	7	64%		0%	1	9%	11
Head & neck (inc. face)	4	50%	3	38%		0%	1	13%	8
Total	**30**	**19%**	**84**	**54%**	**30**	**19%**	**12**	**8%**	**156**

Product Involvement Factor

In the medical record review study, product involvement in burn injuries was categorised based on the PIF categories. Products as the cause of injury (causality) were likely in the three categories: defective, maladapted or misused and high intrinsic risk. In total, approximately 85% of all reviewed cases were in the product causality groups. This included 75% of cases associated with high intrinsic risk products, 9% of injury cases were caused by maladaptation or misuse of products and 1% was caused by defective products (1 case). The remaining burn cases reviewed were related to proximity factors, accounting for 13% of all burn cases. Two per cent were inadequately described to identify the type of product involvement in the injury occurrence.

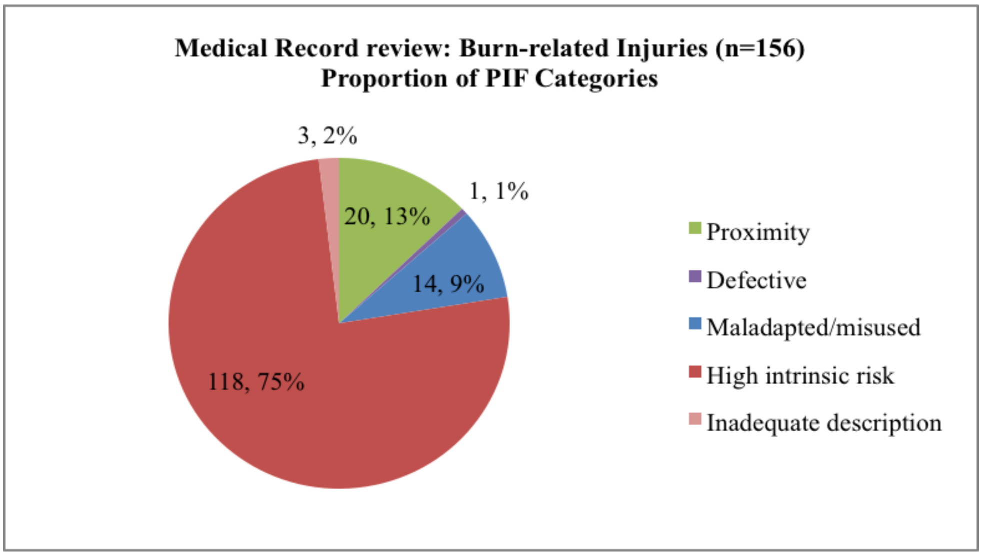


Figure 7-13 Proportion of PIF categories in burn injuries

The proportion of PIF categories was analysed across age groups. Burns related to high intrinsic risk products were more prominent in 1 - 3 year old children. Burns due to maladaptation or misuse of products were identified across age groups, and appeared to be more prominent in older children aged 10 - 15 years old (57%, 8/14). The one burn case due to a defective product was sustained by a 1 year old child. Burns due to proximity factors were more prominent in younger children under the age of 4 years (17 cases) and also in those 10 – 15 years old (3 cases).

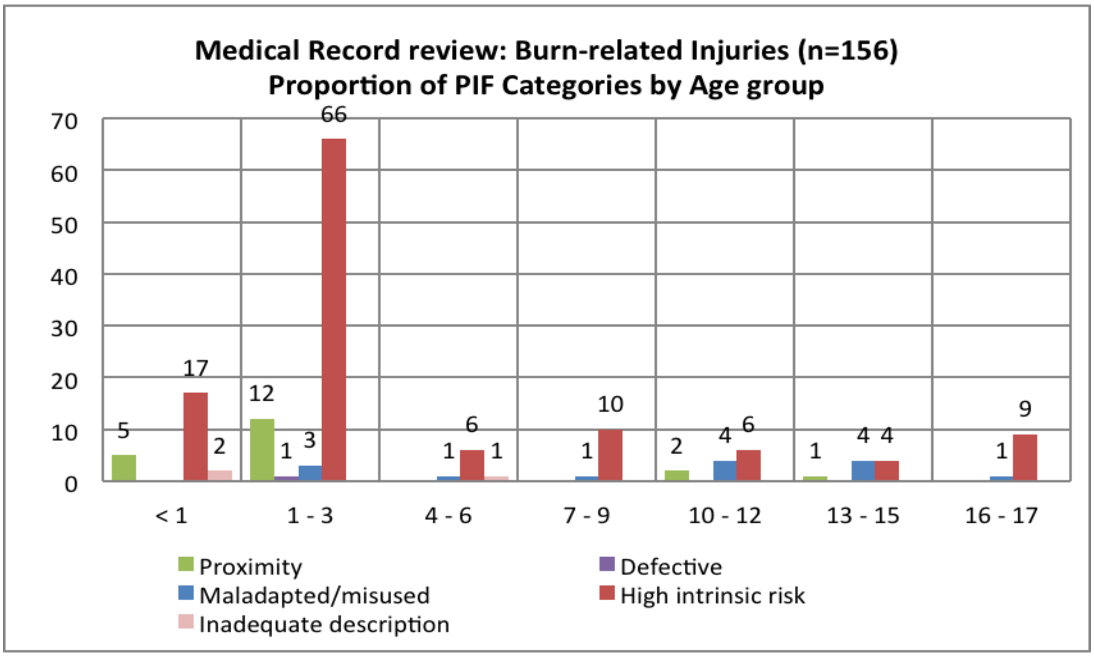


Figure 7-14 Proportion of PIF categories in burn injuries based on age

PIF categories were analysed based on the burn thickness types. As shown in

Table 7-18, full thickness and erythema burns had the highest proportion of high intrinsic risk injuries compared to other types of burn thickness. The proportion of high intrinsic risk injuries was 77% in each burn thickness type. Maladapted or misused products were identified in all burn thickness types, 9 cases resulted in partial thickness burns, 2 cases in erythema burns and 2 cases in full thickness burns.

Table 7-18 PIF categories based on burn thickness & body region

Burn Thickness & Body Region Injured	**PIF Categories (% of row total)**										**Total**	
	Proximity		**Defective**		**Maladapted/ misused**		**High intrinsic risk**		**Inadequate description**			
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%***
Erythema	**4**	**13%**			**2**	**7%**	**23**	**77%**	**1**	**3%**	**30**	**19%**
Upper extremities	1	10%					9	90%			10	6%
Multiple bodily location	1	13%					7	88%			8	5%
Lower extremities	2	40%			1	20%	2	40%			5	3%
Head & neck (inc. face)					1	25%	3	75%			4	3%
Torso							2	67%	1	33%	3	2%
Partial	**10**	**12%**	**1**	**1%**	**9**	**11%**	**62**	**74%**	**2**	**2%**	**84**	**54%**
Upper extremities	2	6%	1	3%	1	3%	28	85%	1	3%	33	21%
Multiple bodily location	1	5%			4	19%	15	71%	1	5%	21	13%
Lower extremities	5	25%			3	15%	12	60%			20	13%
Torso	1	14%			1	14%	5	71%			7	4%
Head & neck (inc. face)	1	33%					2	67%			3	2%
Full	**5**	**17%**			**2**	**7%**	**23**	**77%**			**30**	**19%**
Upper extremities	4	20%			2	10%	14	70%			20	13%
Lower extremities	1	14%					6	86%			7	4%
Multiple bodily location		0%					3	100%			3	2%
Unspecified	**1**	**8%**			**1**	**8%**	**10**	**83%**			**12**	**8%**
Upper extremities	1	17%					5	83%			6	4%
Lower extremities					1	33%	2	67%			3	2%
Torso							1	100%			1	1%
Head & neck (inc. face)							1	100%			1	1%
Multiple bodily location							1	100%			1	1%
Total	**20**	**13%**	**1**	**1%**	**14**	**9%**	**118**	**76%**	**3**	**2%**	**156**	**100%**

* % of total

The type of products causing burn injuries are listed in Table 7-19. Cooking appliances such as saucepans, stoves, barbeques, ovens, and kettles were the most common product group identified in all burn cases reviewed. Approximately 35% of all burn cases were related to a cooking appliance. Heating appliances such as irons, hair straighteners, fireplaces, hair dryers and heaters were the second most common product group identified in all the burn cases, accounting for approximately 14%. The full list of possible injury scenarios for each product type has been developed based on the injury descriptions obtained from the medical record review (see Appendix 12).

The majority of products were regarded as high intrinsic risk products due to the apparent risk of burn associated with these products. Only one product was identified as a defective product as a radiator exploded, exposing the child to hot water. Fourteen injuries were identified as the results of maladapted and misused products. The majority of the maladaptation and misuse of products were related to children playing with flammable substances such as petrol, aerosol cans and paint.

Table 7-19 PIF categories based on product types

Product types	PIF Categories					Total
	Proximity	**Defective**	**Maladapted / misused**	**High intrinsic risk**	**Inadequate description**	
Cooking appliance	**7**		**2**	**46**		**55**
Saucepan/pot				14		14
Stove	2		1	10		13
Barbeque				13		13
Oven	1			6		7
Kettle	4		1	2		7
Jaffle iron				1		1
Heating appliance	**1**			**20**		**21**
Iron				10		10
Hair straightener				6		6
Fireplace	1			2		3
Hair dryer				1		1
Heater				1		1
Flammable substance			**10**	**10**		**20**
Petrol			3	9		12
Aerosol can			7			7
Paint				1		1
Vehicle's part	**2**			**10**		**12**
Exhaust pipe	1			10		11
Wheel	1					1
Bowl	**2**			**8**	**1**	**11**
Cup/glass	**1**			**7**		**8**
Container	**3**			**2**	**1**	**6**
Other (Gym equipment, Cigarette, humidifier, Plastic bag, Steam mop, Radiator, Drum, Plaster mold, Tap, Plastic splash, Clothing, Sparkler, Light bulb, Glue, Lighter, Wading pool, Air gun, Chopping board, Household, chemical)	**4**	**1**	**2**	**15**	**1**	**23**
Total	**20**	**1**	**14**	**118**	**3**	**156**

The PIF categories were analysed based on the length of stay in the hospital and the type of hospital stay. As shown in Table 7-20, injuries due to maladapted or misused products exhibited the longest ALOS (3 days). Injuries due to a proximity product exhibited ALOS of 1.4 days. The proportion of overnight stays was also highest in injuries due to maladapted/misused products (64%). In other PIF categories, the majority of burn cases required same day treatment while there were no overnight hospital stays amongst the injuries due to defective products.

Table 7-20 PIF categories based on length of stay

PIF Categories	Length of Stay					Total
	ALOS	Overnight		Same day		
		n	%	n	%	
Proximity	1.40	4	20	16	80	20
Defective	1.00		0	2	100	2
Maladapted/misused	3.00	9	64	5	36	14
High intrinsic risk	2.21	44	38	73	62	117
Inadequate description	3.67	1	33	2	67	3
Total	**2.19**	**58**	**37**	**98**	**63**	**156**

Triage categories were tabulated based on the PIF categories as shown in Table 7-21. The triage categorisation also showed similar results where the highest proportion of high severity injuries (36%) was amongst burns due to the misuse of products. Injuries due to maladapted/misused products were also classified under medium severity (45%), with 18% under low severity. The proximity injuries comprised 35% of high severity injuries, 35% of medium severity injuries and 29% of low severity injuries. Amongst the high intrinsic risk injuries, approximately 30% of injuries were classified as high severity injuries, 24% were classified under medium severity and 41% were classified under low severity. There was no triage information for the burn case resulting from a defective product.

Table 7-21 PIF categories based on triage categories

PIF Categories	Triage Categories								Total
	High Severity		Medium Severity		Low Severity		Unspecified		
	n	%	n	%	n	%	n	%	
Proximity	6	35	6	35	5	29		0	17
Defective							1	100	1
Maladapted/misused	4	36	5	45	2	18		0	11
High intrinsic risk	29	30	23	24	41	42	4	4	97
Total	**39**	**31**	**34**	**27**	**48**	**38**	**5**	**4**	**126**

Documentation of Product Information

The documentation of product information in the medical records was analysed based on the type of information and the location in the record. Overall, in approximately 38% of all burn cases reviewed, product involvement in the injury event was documented in the presenting problem section of the ED form. In approximately 23% of all burn cases, product involvement was identified in the specialised data collection form for thermal injuries. Product involvement was also documented in Queensland Ambulance Service (QAS) reports, progress notes, nursing assessments, injury proformas, discharge summaries and correspondence letters.

Out of the 156 burn cases reviewed, approximately 37% of injury cases documented the involvement of secondary objects. This information was commonly documented in the presenting problem section of the ED form. Approximately, 20% (31/156) of all burn cases included additional information about the product such the part of product causing the injury and the specific type of product.

Table 7-22 Documentation of product information in burn injuries

Location in Medical Record (Ordered based on order in medical record)	**Product Information (% of total n = 156)**					
	Main object		**Second object**		**Additional info**	
	n	**%**	**n**	**%**	**n**	**%**
QAS Report	17	11%	6	4%	2	1%
Presenting problem (ED form)	59	38%	22	14%	9	6%
Nursing Assessment Data (ED form)	2	1%				
Data Collection for Thermal Injuries form	36	23%	15	10%	11	7%
Injury proforma	1	1%			2	1%
Additional Comments (ED form)	28	18%	11	7%	2	1%
Progress notes	5	3%	1	1%	1	1%
Discharge Summary	2	1%	1	1%		
Correspondence Letter	6	4%	2	1%	4	3%
Total	**156**	**100%**	**58**	**37%**	**31**	**20%**

7.4.4 Discussion

The findings from the medical record review indicate the significant role of text narrative in medical records in establishing product causality in product-related fall and burn cases (RQ 7.2). Similar to the text narrative review study, the product causality which describes the condition where a product plays an essential role in the occurrence of injury or damage, was represented in the defective (PIF 4), maladapted/misused (PIF 5) and high intrinsic risk (PIF 6) categories. In the medical record review study, the proportions of product causality based on the PIF, 4, 5 and 6 in fall-related injuries and burn-related injuries were quantified.

Overall, 26% (157/611) of all reviewed fall and burn cases were identified as product causality likely. Burn-related injuries had a significantly higher proportion of product causality injuries than fall injuries. Approximately 85% of burn-related injuries were classified under product causality categories. This percentage is almost double the thermal effect injuries' product causality proportion in the text narrative review study (47%). Similar to the result in the text narrative review study, high intrinsic risk injuries (75%) comprised the majority of burn cases in this category. This is due to the apparent risks of sustaining a burn from the products identified in the burn injuries such as cooking appliances, heating appliances and flammable substances.

In contrast, fall-related injuries had a significantly lower proportion of product causality injuries, with only approximately 5% of all fall injuries product causality was established as likely. This proportion, however, is still higher than the fall injuries' product causality proportion in the text narrative review study, which was less than 1%. The majority of fall-related injuries were related to proximity factors (64%) and 31% were inadequately described and subsequently it was not possible to establish a product causality judgement. As explained earlier in the text narrative review study, the lack of information in the medical records can be possibly explained by the commonness and regularity of fall injuries. For example, falls from trampolines which comprised the highest proportion of injuries in the inadequate description category were also the most frequent injury presentations in the emergency departments; therefore how these injuries occurred may have been regarded as evident and the documentation not necessarily.

The medical record review in this study has several limitations. Firstly, the results depend significantly on the accuracy and completeness of the information documented by clinical staff. Product types in 12 injury cases were not able to be clarified due to conflicting information from different locations in the medical records. The location of product information in the medical records was also identified, however, the recurrence of such documentation was not captured in the data collection. Moreover, the medical records were manually reviewed and categorised based on the PIF categories by only one coder. Therefore, subjectivity in the categorisation process may also be factor.

7.5 CONCLUSION

Injury data is required as a basic input to the risk assessment process. One of the challenges in utilising admitted patient data in the Product Safety system is that the coded data are limited in their ability to inform the level of product involvement in the injury event. Text narrative data are expected to provide more detail and relevant product information. In this chapter, text descriptions in Queensland injury data and text description in patient medical records were reviewed to extract product information.

The first research question to identify product types in the ED-based injury surveillance data was addressed through the text narrative review. The results showed product types were able to be retrieved from the text narrative data in almost 80% of all injury cases reviewed. Furthermore, the second research question relating to the ability to identify product causality through text narrative data was addressed in both the text narrative review and the medical record review studies using the Product Involvement Factor (PIF). Product causality was quantified by computing the proportion of injuries caused by high intrinsic risk products, defective products and maladapted or misused products. The results showed 6% of all reviewed cases were caused by consumer products. More detailed product causality information was extracted from the medical records compared to the text narratives in injury data especially for burn cases, this can be explained by the serious nature of the injury prompting more detailed documentation.

The results of the product causality analysis are expected to provide input to the prioritisation of product safety issues. Based on the ranking of product causality proportions in all mechanisms of injury, burn injuries were found to have the highest proportion of product causality injuries with almost half (47%) of all burns reported as caused by a consumer product. This result was confirmed through the medical record review, which identified 75% product causality in burn cases.

Both the text narrative review and medical record review processes were subject to several limitations. Firstly, the results presented in this chapter depend significantly to the accuracy and completeness of the information documented by clinical staff. Moreover, the medical records and text narratives were manually reviewed and categorised based on the PIF categories by only one coder. Therefore, subjectivity in the categorisation process may also be factor.

Chapter 8: General Discussion - Prioritisation of Product-related Injuries

Chapter 8: General Discussion - Prioritisation of Product-related Injuries

This chapter discusses the findings reported in the preceding frequency, severity and causality chapters. All findings were combined to prioritise product safety issues in Queensland. Recommendations are made to the ED-based injury surveillance administrator for further development and improvement of injury data and to the product safety regulators for techniques and options to interrogate the currently available injury data.

8.1 FREQUENCY OF PRODUCT-RELATED INJURIES

The frequency of product-related paediatric injuries in this study was analysed in Studies I and III. The results of these studies that are relevant to the frequency of product-related injury were combined in Chapter 5. A proactive approach was used to identify prominent issues contained in injury data by using product codes to analyse both ED-based injury surveillance and hospital admission data.

The findings showed both similarities and variations in the results of the analysis of ED-based injury surveillance and hospital admission data in terms of frequency of injuries. Demographically, there were several similarities in the pattern of overall injuries. Findings from both datasets showed a peak of injury frequency in children aged 1 – 3 years old. A secondary peak in injuries was identified as part of the analysis of paediatric ED-based injury surveillance data, around the age of 10-12 years. Slightly different results were mirrored in the hospital admission data where the peak was marginally older; 13-15 years. Differences in the severity of injuries are likely to explain this variation as the ED-based injury surveillance and hospital admission data are collected at different levels of care. The ED-based injury surveillance data are collected from presentations to emergency departments with some injuries being treatable in the department and able to be discharged without being admitted to the hospital. The hospital admission data, on the other hand, are collected from injury hospitalisations where more than one day of admitted medical treatment was required in hospital. As a result, the two secondary peaks in each of the data sources may indicate that there were more severe injuries sustained by the 13-15 year olds, which warranted hospital admission, compared to those in the 10-12 year old category.

The overall proportions of product-related paediatric injuries were similar in both datasets (ED-based injury surveillance data 39% and hospital admission data 32%). The breakdown by age groups also showed similar patterns of increases and decreases between both datasets, with the percentage of product-related injuries being highest in infants (< 1 year old) and 4 – 6 year olds, while they were lowest in teenagers aged 16 – 17 years old. The percentage of product-related injuries in all age groups, however, was slightly higher in the ED-based injury surveillance data compared to the hospital admission data. This variation may also be related to the difference in the severity of injuries, as ED-based injury surveillance and hospital admission data are collected at different levels of care as previously discussed. This indicates that there were a number of less severe product-related injuries captured by the ED-based injury surveillance data that were not captured in hospital admission data.

In the in-depth analyses of both datasets, there were several differences found. The variations were related to the classifications used in the datasets, where hospital admission data were classified using multiaxial external cause codes, enabling a single code to represent both the mechanism of injury and the object involved in the injury event. ED-based injury surveillance data, on the other hand, were classified separately for each aspect of an injury, with objects and mechanisms coded distinctively. Differences were also identified in the way mechanisms of injury were grouped and in the terminology used in each coding system. ICD-10-AM codes used for product-related injuries in hospital admission data were grouped into burn, exposure to electric current and radiation, drowning, falls, poisoning, exposure to mechanical forces, threats to breathing and transport accidents. Meanwhile, product-related injuries in ED-based injury surveillance data were grouped into falls, struck against object, crushing and piercing, acute over-exertion, foreign body, thermal effect, chemical effect and electrical effects. These variations add to the complexity of comparing findings from both data sources. Further code mapping and re-categorisation can be done to standardise the groupings and terminology. This process was not conducted in current study, however can be an input to future work if such standardisation is required.

The frequencies of injury under different mechanisms were obtained to allow for mechanisms of injury to be ranked based on frequency. The results from ED-based injury surveillance data analysis showed high frequency of product-related injuries related to falls, struck and hit by object and crushing or piercing. The results from hospital admission data analysis showed high frequency of product-related injuries related to falls, product-related transport accidents and exposure to mechanical forces. These results from analyses of both datasets indicate similar findings showing high frequency of falls and exposure to mechanical forces (in the ED-based injury surveillance data represented by struck and hit by objects and crushing or piercing).

8.2 SEVERITY OF PRODUCT-RELATED INJURIES

The severity of product-related injuries in this study was analysed in Studies II and III. The results of these studies that are relevant to the severity of product-related injuries were combined and described in Chapter 6.

Several measures were used to examine injury severity under different mechanisms of injury, with the methods also allowing for mechanisms of injury to be ranked based on all severity measures. The mechanisms of injury that resulted in the most severe injuries presenting to emergency departments were identified in the ED-based injury surveillance data analysis. Three ED-based injury surveillance-based severity measures were used in this analysis: triage categories, mode of separation and SRR. Furthermore, the mechanisms that resulted in the most severe injuries which required hospital admission were identified in the hospital admission data analysis. Three hospitalisation-based severity measures were used in this analysis: length of stay, mode of separation and ICISS scoring.

Mode of separation was used as a severity measure in the analyses of both ED-based injury surveillance and hospital admission data. However, the categories in the mode of separation fields from both datasets were different as they represent different levels of care in the hospital. In the ED-based injury surveillance data, the mode of separation represents the referral destination of patients after treatment in the ED, whereas in the hospital admission data, the mode of separation represents the referral destination of patients after admission to the hospital. In the ED-based injury surveillance data, severity of injury was measured based on the proportion of injuries resulting in death or admission to the hospital after treatment in the ED. In the hospital admission data, severity of injury was measured based on the proportion of injuries resulting in death, transfer to another hospital or change of episode type.

Based on the analysis of mode of separation data, injuries due to thermal effects had the highest proportion of hospital admission in the ED-based injury surveillance data, with 33% of injuries associated with this mechanism resulting in hospital admission or transfer to another hospital. In the hospital admission data, the proportion of hospital transfers and episode type changes were the highest in the injuries coded as threats to breathing, which included strangulation and suffocation, accounting for 36% of total hospital transfers/episode changes. This exposed differences in the results of mode of separation in both datasets which may be explained by the differences in levels of care represented by both datasets.

The SRR was used as a severity measure in the analyses of both ED-based injury surveillance and hospital admission data. ICD codes in both datasets were used to assign an SRR for each injury case. However, there were differences in the application of the SRR in both datasets due to the availability of ICD codes. The ED-based injury surveillance data only stored one ICD code detailing the principal diagnosis of the injury, and therefore, only a single SRR was assigned to each injury case. The hospital admission data on the other hand, contained the full set of ICD principal and additional diagnoses, and SRRs from all ICD codes in each injury case were multiplied to obtain an ICISS score.

The use of an SRR in ED-based injury surveillance data is affected by reliability issues as it has only previously been used for hospital admission data where co-morbid conditions are coded. It has not been used in the past for emergency department single diagnosis data. Hence, it may not be as valid a severity indicator for ED cases as it is for hospital cases. Moreover, using SRRs only is not as reliable as the full ICISS scoring based on the complete range of ICD diagnoses codes. However, the SRR severity measure is the only available injury-based severity measure applicable for ED injury data which includes only the principal diagnosis. This severity measurement was conducted as supplementary to other severity measures.

The severity ranking based on the SRR analysis from the ED-based injury surveillance data showed the lowest minimum SRR was for injuries due to thermal effects, with a minimum SRR of 0.545. This finding was confirmed by the findings in the mode of separation analysis in which thermal effect injuries were also the highest in the severity ranking. Injuries due to falls and being struck and hit by objects were second in the severity ranking with a minimum SRR of 0.571.

The severity ranking based on the ICISS score analysis in the hospital admission data showed slightly different results, with product-related transport accidents shown to rank as the most severe injuries, with a minimum ICISS score of 0.054. Injuries due to exposure to electric current or radiation were second in the severity ranking with a minimum ICISS score of 0.338.

The triage category analysis was conducted to inform injury severity in the ED-based injury surveillance data. Triage categories as a tool to prioritise patients for emergency department treatment are only available in this dataset. In this study, triage categories were further grouped into three severity categories: high severity (triage categories 1 and 2), medium severity (triage category 3) and low severity (triage categories 4 and 5). Based on the results above, injuries due to chemical effects had the greatest proportion of high severity injuries, with approximately 28% of injuries under this mechanism requiring resuscitation or ED treatment within 10 minutes. Ranking second in the triage category analysis were suffocation injuries, with 18% of these classified as high severity.

The use of triage categories as a severity measure is affected by several issues. Firstly, the triage scoring scales were designed mainly to reflect the urgency of ED treatment required and may not necessarily reflect injury severity (FitzGerald, et al., 2010). Secondly, triage categorisation may be affected by previous treatment before the patient presented to the ED. For example, an injured patient who is stabilised by ambulance staff prior to presenting at an ED may be categorised at the lower end of the triage scale. Including the admission source may be useful in understanding and taking into account any pre-ED treatment. However, this information is not yet included as an ED-based injury surveillance data item.

In the hospital admission data analysis, length of stay (represented by the number of days the patient stayed in the hospital) was used as a severity indicator.

The results showed that injuries due to threats to breathing had the highest ALOS of 2.82 days. This was followed by injuries due to thermal effects, ranked second by severity with ALOS of 2.43 days. This finding confirmed the results from the severity analysis conducted using mode of separation data in which the mechanism ‘threats to breathing’ was also ranked highest in severity.

A product safety-based severity scoring system, RAPEX, was applied to both datasets. Based on the mapping of ICD codes into RAPEX severity levels (Appendix 8), burn injuries were selected for this analysis. The application of RAPEX severity levels to both ED-based injury surveillance and hospital admission data demonstrated several differences. The application of RAPEX severity levels to the ED-based injury surveillance data was conducted based on burn thickness and admission status only, whereas in the hospital admission data, burn thickness, burn surface area (BSA) and procedures performed during the hospital stay were all included. This contributed to the difference in the results in which more burn cases were classified above the severity threshold in the ED-based injury surveillance data than in the hospital admission data. Approximately 49% of all burn cases were classified above the severity threshold (RAPEX 3 and 4) and 22% below the severity threshold (RAPEX 1 and 2) in the ED-based injury surveillance data. Meanwhile, in the hospital admission data, approximately 26% of all burn cases were classified above the severity threshold and 69% under the severity threshold.

The information about the body surface area burned played a significant part in the RAPEX categorisation. However, this information is not included in the ED-based injury surveillance data as it is often coded as an additional ICD code for hospitalised cases and is not prioritised for capture in the single diagnosis recorded in ED-based injury surveillance data. Furthermore, around 5% of burn cases in the hospital admission data were unclassifiable in the application of RAPEX severity level due to the body surface area not being specified.

The overall severity ranking was obtained by calculating the average of all severity rankings from all severity measures. Based on the results from the ED-based injury surveillance data analysis, injuries due to thermal effects, falls and suffocation injuries were the top three mechanisms of injury that resulted in the most severe injuries presenting to emergency departments. This finding was obtained based on a severity analysis using triage categories, mode of separation and SRR. Based on the results from the hospital admission data analysis, injuries due to product-related transport accidents, threats to breathing and exposure to electrical current and radiation were the top three mechanisms of injury that resulted in the most severe injuries requiring admission to hospital. This finding was obtained based on the severity analysis using length of stay, mode of separation and ICISS scoring system.

There are several differences in these results that may be influenced by the varying levels of care between emergency department treatments and hospital admissions. However, injuries due to threats to breathing, which include strangulation and suffocation, appeared to be included in both emergency department and hospitalisation severity rankings.

Mechanisms of injury that resulted in the most severe injuries tended to be less frequent. Injuries due to suffocation, electric and radiation effects, chemical effects and thermal effects, which resulted in the most severe injuries based on the findings in this chapter, were ranked in the bottom 5 of the frequency ranking.

8.3 CAUSALITY OF PRODUCT-RELATED INJURIES

The causality analyses of product-related injuries were conducted in Study II and IV through the manual review of text narratives available in injury data and medical records. The results of the studies that are relevant to the causality of product-related injuries were combined in Chapter 7.

The findings from the text narrative review indicate that text narrative data plays a significant role in identifying the types of products involved in injury cases and are also essential in establishing product causality. The types of objects involved in the injuries were able to be retrieved from the text narrative data in almost 80% of all injury cases reviewed in the text narrative review. Types of product under other regulations in Australia and non-manufactured objects were able to be excluded from a range of consumer products during the Product Involvement Factor (PIF) categorisation process. This is consistent with the findings from Jones and Lyons's study in which text narrative data were found to reduce the proportion of unknown cases (Jones & Lyons, 2003). The results in this study also confirmed the findings from Bauer and Sector's study that found that a PIF categorisation tool is useful to identify product-related cases in injury data (Bauer & Sector, 2000).

Product causality describes the condition where products play the primary role in the occurrence of injury or damage, and are able to be classified in defective (PIF 4), maladapted/misused (PIF 5) and high intrinsic risk (PIF 6) categories. The quantification of product causality based on the proportion of PIFs 4, 5 and 6 allowed the mechanisms of injury to be ranked. These findings can be used in addition to the frequency and severity findings in the previous chapters to construct a method to prioritise product safety issues.

Overall, 44% of all reviewed sample cases in ED-based injury surveillance data were associated with a variety of consumer products in which different types of involvements were identified. However, only 6% were established as direct product causality. The majority of product-related injuries were related to proximity factors (25%). However, 13% were inadequately described to enable a judgement about product causality. The lack of information in the injury descriptions can possibly be explained by the commonness and regular occurrence of several injury types. For example, falls from bicycles and trampolines which comprised the highest proportion of injuries in the inadequate description category were also the most frequent injury presentations in the emergency departments; therefore how these injuries occurred may have been regarded as evident and not necessary to be clarified in the clinical documentation.

The exclusion of proximity and inadequate description categories from product causality indicators may have impacts in the prioritisation of product safety issues. Hence, products such as furniture (which was the most common proximity product), bicycles, trampolines, skateboards, scooters and other hazardous products may have been missed by the product safety prioritisation. In order to improve the prioritisation process, this limitation can be addressed by considering the products causing a large number of injuries as high intrinsic risk. Bicycles, scooters, skateboards and trampolines, for example, are known to impose high risks of falling amongst children. Therefore, injuries related to these products can be classified as high intrinsic risk.

Product causality analysis was also conducted on hospital admission cases through the medical record review. However, due to time and resource limitations, only fall and burn cases were included in the review. The results of this review indicate the significant role of medical record text descriptions in establishing product causality in product-related fall and burn cases. Similar to the text narrative review study of ED-based injury surveillance data, the product causality was represented in the PIF 4, 5 and 6.

Overall, 26% (157/611) of all reviewed fall and burn cases were identified as product causality likely. Burn-related injuries had a significantly higher proportion of product causality injuries than fall injuries. Approximately 85% of burn-related injuries were classified under product causality categories. This percentage is almost double the thermal effect injuries' product causality proportion in the text narrative review study in ED-based injury surveillance data (47%). Similar to the result in the text narrative review study, high intrinsic risk injuries (75%) comprised the majority of burn cases in this category. This is due to the apparent risks from the products identified as causing burn injuries such as cooking appliances, heating appliances and flammable substances.

By contrast, fall-related injuries had a significantly lower proportion of product causality injuries, with only approximately 5% of all fall injuries established as product causality likely. This proportion, however, is still higher than the fall injuries' product causality proportion in the text narrative review study in ED-based injury surveillance data, which was less than 1%. The majority of fall-related injuries were related to proximity factors (64%). However, 31% were inadequately described and subsequently it was not possible to establish a product causality judgement. As explained earlier in the text narrative review study, the lack of information in the medical records can be possibly attributed to the commonness and regularity of fall injuries. For example, falls from trampolines, which comprised the highest proportion of injuries in the inadequate description category, were also the most frequent injury presentations in emergency departments and how these injuries occurred may have been regarded as evident and not requiring additional clarification in the clinical documentation. This suggests that the utility of data in determining causality may vary for different mechanisms.

The text narrative review and medical record review in this study have several limitations. Firstly, the results depend significantly on the accuracy and completeness of the information documented by clinical staff. The quality of text narratives in ED-based injury surveillance data, which were collected at the point of triage in the emergency department, may be affected by the urgency of the injury condition.

Furthermore, in the medical record review, product types in some cases were not able to be clarified due to conflicting information from different locations in the medical records. The location of product information in the medical records was identified, however; the recurrence of such documentation in more than one place was not captured in the data collection. Moreover, the text descriptions were manually reviewed and categorised based on the PIF categories assigned by only one coder. Similarly, in the medical record review, all patient records were manually reviewed and categorised based on the PIF categories assigned by only one coder. Therefore, subjectivity in the categorisation process may also be factor.

8.4 PRIORITISATION OF PRODUCT SAFETY ISSUES

A prioritisation framework using a set of preventability criteria has been used with the European injury data in the preventative product safety analysis study project conducted by the Institute Sicher Leben, as discussed earlier in the literature review. The study proposed three criteria for product safety prioritisation to be used in injury data analysis: frequency, severity and product causality (Bauer & Sector, 2000).

In this study, injury data have been analysed in terms of these three criteria. There were differences in the application of each criterion as Australian data are different in the structure as well as in the classification systems used. However, the European criteria were still applicable to the injury data used in this study. The prioritisation of product safety issues in this study was conducted on mechanism of injury groups instead of the product type groups. This is the first time a prioritisation process of this kind has been used in Australia, and the findings offer a new methodology for utilising injury data to set priorities in product safety.

8.4.1 Equal Weighting of Prioritisation Criteria

In order to prioritise product safety issues based on these three criteria using injury data, all relevant findings from the frequency (Chapter 5), severity (Chapter 6) and causality (Chapter 7) analyses were combined in the product safety prioritisation table (Table 8-1 and Table 8-2). The prioritisation of mechanisms of injury was conducted by computing the average of rankings in each mechanism group from all the rankings of frequency, severity and causality. All three criteria bring equal significance to the prioritisation process. Frequency of injury accounts for cost for the health departments and has been used widely as measure of injury burden (Driscoll, et al., 2004a). Severity of injury accounts for the consequences of the issue and is part of the product safety regulators' advocacy to focus on the most serious product related issues (Productivity Commission, 2006). Lastly, the causality of injury accounts for the preventability of the product safety issue and the effectiveness of the initiatives to address the issue (Stevenson, 2004).

There is a tendency for negative correlations between the three criteria. Previous studies found that product causality, for example, tends to decrease as the severity increases (Bauer & Sector, 2000). Therefore, if product causality is given a greater weighting than severity, the prioritisation process may overlook product safety issues that have more severe consequences. Similarly, the frequency of severe injuries is often less than the frequency of less severe injuries as indicated in the findings in Chapter 6. Therefore, if more weighting is given to frequency, the prioritisation process is likely to omit the more severe product safety issues.

Severity is often weighted more than other criteria to allow product safety regulators to focus on more serious issues. Therefore, equal weighting can be considered unsuitable to deliver this focus if it allows the most serious issues to be pushed down the prioritisation list and potentially overlooked. However, if more weighting is given to severity, the prioritisation process might focus on the more serious issues which aren't necessarily caused by consumer products and might only focus on specific groups of the population who are exposed to certain types of product safety issues, neglecting to consider the wide range of product safety issues prevalent in the general population. While unequal weighting may be applicable for specific issues, the study used equal weighting for the three criteria. This method is regarded as the most appropriate approach to account for all product-related issues in children.

8.4.2 Product safety prioritisation table

Based on the results from an analysis of Queensland ED-based injury surveillance paediatric data, injuries due to thermal effects, foreign bodies and falls were at the top of the prioritisation ranking. Injuries due to thermal effects were first in the prioritisation ranking with an average of rankings of 2.7. While these injuries were comparably lower ranked than other mechanisms in terms of frequency (6^{th}), injuries due to thermal effects were ranked first in terms of severity and product causality, indicating that a large number of these injuries were caused by consumer products and the consequence of these injuries was normally high in severity. This finding contradicts with the findings in previous study by Bauer & Sector (2003) which showed a negative correlation between product causality and severity. This could be accounted by the adjustments in the methodology of product involvement categorisations. However, this should be further investigated in future studies to confirm the relationship between product causality and severity.

Injuries due to foreign bodies were second in rank, with an average of rankings of 4. Similar to thermal effect injuries, the frequency of injuries in this mechanism group was quite low compared to other mechanisms (5^{th}), however, in terms of severity and product causality, foreign body injuries were ranked higher than other mechanisms. Falls injuries were the third in the rank with an average of rankings of 4.3. Injuries due to falls were first in the frequency ranking and were second in the severity ranking. However, in terms of product causality, fall injuries were the lowest in rank.

The low product causality in falls may be attributed to the large proportion of product-related falls being related to proximity factors as highlighted in the results of text narrative and medical record reviews (Section 7.3.1 and 7.4.2). Even though product proximity-related injuries are not included within product causality, there is considerable scope for prevention through the adoption of product safety initiatives targeted at reducing the number of product-related falls. Protective equipment on products with a high potential risk for falls could be introduced to address proximity related falls. Moreover, safety messages to raise awareness of the risks associated with products that commonly cause injuries can be also utilised to address this issue.

The product safety prioritisation based on frequency, severity and causality criteria are somewhat aligned with the current product safety focus in Australia, with several products related to thermal effect, foreign body and fall hazards already placed under specific Australian regulations. Seven out of the 21 bans imposed on specific products were due to small parts or elements that may pose choking, ingestion and lodgement hazards. These banned products include baby dummies and baby dummies' chains with unsafe decorations, Glucommannan tablets, high-powered small magnets, mini jelly cups containing konjac, tongue studs without holes, and toys containing beads (ACCC, 2014c). Furthermore, 4 products were banned due to the burn hazards including combustible candle holders, fire footbags, sky lanterns that rely on open flames and toy-like novelty cigarette lighters (ACCC, 2014c). There is no current ban on products due to fall hazards, however, several products such as baby walkers, bicycles, exercise bicycles, cots and prams have been regulated under the mandatory standards (ACCC, 2014b).

As previously discussed, while equal weighting may be accompanied by concerns that the most serious product safety issues may be usurped by frequency and product causality criteria and thereby shifted down the prioritisation chain, this was not proven to be the case in the study's findings. As shown in Table 8-1, mechanisms of injury that caused the most serious injury, had the most frequent incidents and had the highest proportion of product causality were kept at the top of the prioritisation rank when an equal weighting approach to the criteria was applied.

Table 8-1 Product safety prioritisation table based on the ED-based injury surveillance data

Mechanism of injury group	Frequency		Severity									Causality		Average of rankings	Prioritisation Ranking
	Number of product-related injuries	Frequency ranking	% of severe injuries	Triage Ranking	% of admission/ death	Severe outcome ranking	Min SRR	Ave SRR	SRR ranking	Mean Severity	Severity Ranking	% of product causality likely (PIF 4-6)	Product Causality Ranking		
Thermal effect	736	**6**	8.29%	4	32.74%	1	0.545	0.991	1	2.00	**1**	47.06%	**1**	2.7	**1**
Foreign body	1016	**5**	5.31%	6	12.40%	5	0.838	0.997	6	5.67	**4**	33.87%	**3**	4.0	**2**
Fall	13940	**1**	6.39%	5	15.92%	4	0.571	0.990	2	3.67	**2**	0.21%	**10**	4.3	**3**
Chemical effect	561	**7**	27.27%	1	20.14%	3	0.838	0.991	8	4.00	**3**	29.14%	**4**	4.7	**4**
Crushing, piercing	3445	**3**	2.29%	10	9.38%	6	0.745	0.993	4	6.67	**6**	21.55%	**6**	5.0	**5**
Struck, hit by contact with object	6724	**2**	3.41%	9	8.12%	8	0.571	0.991	3	6.67	**6**	1.83%	**8**	5.3	**6**
Suffocation	33	**10**	18.18%	2	27.27%	2	0.838	0.951	7	3.67	**2**	26.09%	**5**	5.7	**7**
Electric, radiation effect	67	**9**	11.94%	3	4.48%	9	0.961	0.993	10	7.33	**7**	40.00%	**2**	6.0	**8**
Other and unspecified mechanism	290	**8**	4.48%	7	8.62%	7	0.800	0.991	5	6.33	**5**	3.66%	**7**	6.7	**9**
Acute over - exertion of body part	3028	**4**	3.57%	8	2.51%	10	0.860	0.997	9	9.00	**8**	0.30%	**9**	7.0	**10**
Total			**91%**				**0.545**								

Based on the results from Queensland hospitalisation paediatric injury data analysis, injuries due to product-related transport accidents and threats to breathing were at the top of the prioritisation ranking (Table 8-2). The prioritisation ranking, however, was only conducted using frequency and severity criteria, as a product causality analysis could not be conducted in hospital admission data due to the unavailability of the text narrative data to enable product involvement judgement. Product-related transport accidents were first in the prioritisation ranking with average of rankings of 1.5. Injuries coded under this mechanism ranked second in frequency and first in the severity rankings. Injuries due to threats to breathing are second in the prioritisation ranking. In terms of severity, these injuries were in the top ranking however, the frequency of these injuries was quite low compared to other mechanisms.

As product causality was not factored in, these rankings may be changed if the causality factor is included in the criteria. For example, product-related transport accidents may fall to a lower ranking, as transport accidents are commonly related to other factors and the product involvement may not be the primary cause. This highlights the significance of the causality parameter in the prioritisation process to ensure that the issues being addressed fall within the scope of product safety initiatives. There is also some overlap with the transport and road departments in addressing transport accidents, even though off-road transport is often overlooked. Current product safety initiatives relating to transport accidents have been introduced through mandatory standards regulating the design of helmets for bicycles and motorcycles (ACCC, 2014b).

Product causality in injuries due to threats to breathing and electric current exposure are assumed to be high as illustrated by the findings in the ED-based injury surveillance data analysis. Injuries due to threats to breathing, for example, may resemble the foreign body injuries which showed significant levels of product causality compared to other mechanisms (Section 7.3.1, Table 8.1). Similarly, injuries due to electric currents in ED-based injury surveillance data were also shown to involve a substantial level of product causality. Therefore, the absence of product causality parameters may not affect the prioritisation ranking of injuries due to threats to breathing and electric current exposure.

Several products related to these mechanisms are currently restricted by product safety regulations. These include the seven products that were banned due to their small parts or elements that may pose choking, ingestion and lodgement hazards as mentioned above and one banned product, miniature motorbikes that was banned due to the risk of serious injury or death from accidents (ACCC, 2014c). Several products such as bicycle and motorcycle helmets are also regulated under mandatory standards due to the risk of serious head injury or death in accidents if the use of helmet is ineffective (ACCC, 2014b).

Table 8-2 Product safety prioritisation table based on the hospital admission data

Mechanism of injury groups	Frequency				Severity								Average of rankings	Prioritisation Ranking
	Number of total injuries	Number of product related injuries	% of product related injuries	Frequency ranking	Average Length of Stay (ALOS)	ALOS Ranking	% of death/transfer	Severe outcome ranking	Minimum ICISS	ICISS ranking	Mean Severity Ranking	Severity Ranking		
Transport accidents*	9237	4480	24%	2	2.03	3	11.34%	4	0.0540	1	2.7	1	1.5	1.0
Threat to breathing	180	28	0%	8	2.82	1	39.29%	1	0.9291	7	3.0	2	5.0	2.0
Exposure to electric current or radiation	68	51	0%	7	1.57	4	9.80%	5	0.3375	2	3.7	3	5.0	2.0
Thermal effect	2376	696	4%	4	2.43	2	8.76%	6	0.7097	6	4.7	4	4.0	4.0
Drowning	294	136	1%	6	1.49	5	18.38%	2	0.9601	8	5.0	5	5.5	5.0
Chemical effect	2116	523	3%	5	1.42	7	11.47%	3	0.5732	5	5.0	5	5.0	6.0
Exposure to mechanical forces	14395	3119	17%	3	1.48	6	8.66%	7	0.4241	3	5.3	7	5.0	6.0
Falls	23265	9721	52%	1	1.29	8	7.56%	8	0.5009	4	6.7	8	4.5	8.0
Total	**51931**				**1.82**									

* Product-related transport accidents are excluded from the recommendations for below reasons:

- Product causality is assumed to be low, as transport accidents often involve other factors
- There are some overlaps with the transport and road department to address transport accidents in general.

8.5 STRENGTHS AND LIMITATIONS

There are several strengths and limitations that need to be acknowledged. In general, the study focused on children's data only and therefore, the findings and recommendations of this study are appropriate to address product safety issues in children. However, the approaches and techniques used in this study can also be applicable to the general population. The study also only used paediatric injury cases that occurred between 2008 and 2010. Therefore, the findings are constrained to representing the pattern and characteristics of the product-related injuries over this time. However, the outcome of this study, which aims to develop and evaluate approaches for utilising injury data for product safety purposes, can be used in the future to interrogate injury data for other purposes relating to product safety.

The study used ED-based injury surveillance data which only covered a sample of public hospitals in Queensland. This may affect the ability of the study to estimate state wide product-related injury rates as data may not be representative of all emergency department injury presentations in Queensland. However, the study also used hospital admission data, which covered state wide hospitalisation for injuries. This highlights the value of utilising more than one injury data source.

The use of ED-based injury surveillance and hospital admission data may create some overlaps, however as shown in the results, there are differences in the severity of injury. This shows a benefit of using multiple injury data sources in the prioritisation of product safety issues to represent different levels of care. Furthermore, both ED-based injury surveillance and hospital admission data are episode-based, not person-based. Therefore, there is the possibility of a patient's re-presentation or re-admission that were not considered in this study.

Several strengths and limitations, which are specific to the methodology used in each of the frequency, severity and causality analyses, are outlined below:

Identification of product-related injury

The identification of product-related injuries in the ED-based injury surveillance and hospital admission data in this study were aligned with the definition of consumer products as outlined in Chapter 1. By adopting the jurisdictional approach to the inclusion and exclusion of specific products, this study can provide specific inputs to the Australian product safety regulators that are compatible with the scope of their authority. However, by adopting this approach, this study may have overlooked other issues that are relevant to other jurisdictional bodies and product safety regulators in other countries.

The identification of product-related injuries in the ED-based injury surveillance and hospital admission data depends on the quality of injury coding. To provide more details of product-related injury cases, text narratives are available in the ED-based injury surveillance data to validate the codes, however, researchers need to conduct a manual review of individual text narratives, a process which can be time consuming and may be prohibitive to some studies. For hospital admission data that does not contain text narratives, medical record reviews can be conducted. This process, however, requires hospital visitations and can be time consuming and labour intensive.

The study was somewhat restricted from obtaining the incidence rate of product-related injuries due to the unavailability of data on person-time exposure to products which was complicated by the number of products available in market (ACCC, 2014d; Indrayan & Sarmukaddam, 2001). A survey has been conducted by the ABS in 2001 (Safety in the home study) to collect information about the exposure to certain types of safety features and consumer products in the home (Australian Bureau of Statistics, 2001). While there is an opportunity to use the survey data to obtain exposure to consumer products, there were no updated results to accommodate the current study's period (2008 – 2010). Furthermore, the survey focus specifically on children aged 0-4 and older people; and only on specific types of product such as such as hand rails; non-slip surfaces; smoke detectors and temperature controlling devices for hot water systems, swimming pools and playground equipment.

However, while risks without exposure estimates limit the ability to understand product risk rates, decision makers are still likely to respond to high frequency and high severity issues regardless of whether the product is high in circulation (Productivity Commission, 2006).

Analysis of product-related injury severity

In the analysis of product-related injury severity, there are several strengths and limitations associated with the stand-alone severity measures. In order to overcome these limitations, multiple measures were interpreted concurrently in order to provide more context to the injuries and therefore act as proxy indicators of severity. In isolation, each of the severity measures has reliability issues as discussed below:

The triage scoring scales, normally used in ED settings to reflect the urgency of treatment, may not necessarily reflect injury severity as they are urgency measures, rather than severity measures. The triage categorisation may be affected by previous treatment before the patient presented at the ED (e.g. by ambulance officers etc.), the nature of the injury and its initial assessment, other patient priorities at the time of ED presentation and other miscellaneous factors. The use of SRRs in ED-based injury surveillance data is subject to reliability issues as it has only been used for hospital admission data where co-morbid conditions are coded. It has not been used previously for emergency department single diagnosis data. Hence, it may not be as valid a severity indicator for ED cases as it is for hospital cases.

Using SRRs only is not as reliable as the full ICISS scoring based on the complete range of ICD diagnosis codes. However, the SRR severity measure is the only available injury-based severity measure applicable for ED injury data which includes only the principal diagnosis. This severity measurement was used to supplement other severity measures for this research.

The application of RAPEX severity ratings in injury data can provide more readily available information to support product safety risk assessment using RAPEX tools. However due to the extent of compatibility between the RAPEX coding and the health classification used in injury data as highlighted in Appendix 8, the RAPEX severity scoring system was only applied on a sample of burn cases.

Furthermore, disability outcomes relating to product-related injury are an important measure of severity. However, as ED-based injury surveillance and hospital data do not capture disability metrics well, therefore this was not included in the study. There were several studies conducted to explore predictions of disability using injury data as highlighted in section 4.3; however the methods are yet to be validated. For future work when disability metrics are available, it is crucial to consider long term disability outcomes in the prioritisation of product safety issues.

Analysis of product causality

There are also several strengths and limitations associated with the methodology used in analysing product causality. Firstly, the exclusion of proximity and inadequate description categories from product causality indicators in this research may have impacted on the prioritisation of product safety issues. Hence, products such as furniture (which was the most common proximity product), bicycles, trampolines, skateboards, scooters and other hazardous products may have been missed in the product safety prioritisation. However, this was necessary to retain the consistency with previous work in this field. Future research may explore inclusion of different causality categories.

Moreover, the analysis of product causality was based on the review of text narrative injury data and a medical record review. The results depend significantly on the accuracy and completeness of the information documented by clinical staff. By identifying the location in the medical record with the best source of product information, this research can assist in directing training efforts for clinical staff to improve the documentation of injury and product information in the future.

The text descriptions were manually reviewed and categorised based on the PIF categories by only one coder. Similarly, in the medical record review, all patient records were manually reviewed and categorised based on the PIF categories by only one coder. Statistical analysis to reduce the subjectivity of categorisation was not conducted as it requires blind coding conducted by a different coder. This was not in the scope of time and resources of this study. Therefore, subjectivity in the categorisation process may also be a factor, though the use of well specified inclusion and exclusion criteria for each PIF category helped minimise the subjectivity bias.

8.6 RECOMMENDATIONS

Based on the findings of this study, in order to improve product safety initiatives in children, several recommendations have been formulated and are applicable to the roles of product safety regulators, the injury data custodians and health classification administrators. The recommendations are focussed on improving product safety information to address issues and risks posed to children as the study only focused on analysis of product-related injury data in children. However, several recommendations relating to methodology and techniques may also be applicable to the general population. These recommendations are outlined below.

8.6.1 Product Safety Regulators

The research's recommendations for product safety regulators are divided into two sections, short term and long term recommendations. The short-term recommendations include actions that are considered more applicable and feasible in the current product risk assessment processes in Australia. There are also recommendations that can be applied in the long term.

Short-term recommendations

Injury data, as a vital source of information for the product safety systems, could be used more regularly and in greater detail to address product safety issues in children. In the short term, several recommendations are proposed based on the results of this study. Firstly, the RAPEX severity rating system could be incorporated with other ED-based injury surveillance and hospitalisation-based severity measures such as triage scores and modes of separation. Severity information from injury data should be considered in the RAPEX severity analysis. For example, high severity injuries with a triage category of 1 or 2, and injuries resulting in hospital admission or transfer to another hospital should be included in the higher RAPEX rating (3 or 4). Secondly, in order to simplify the application of RAPEX severity ratings in injury data, the guideline for the application of severity ratings should be revised to be more aligned with information from injury data. The categorisations of RAPEX severity ratings can be adjusted to align with the injury classification systems such as ICD-10-AM and NDS-IS.

Furthermore, in the short term, based on findings from the analysis of the ED-based injury surveillance data using a proactive approach, product safety initiatives in children should be prioritised to injuries related to thermal effects, foreign bodies and falls. Additionally, based on findings from the analysis of the hospital admission data, product safety initiatives in children should also address product-related injuries concerning threats to breathing and exposure to electric currents.

Research should be commenced to explore the types of products commonly causing these injuries and the pattern of these injuries in children. Products associated with these mechanisms of injury should be more closely monitored, perhaps through the creation of specialised teams in the product safety department. The three E's of injury prevention: 1) education, 2) ergonomics, engineering and design and 3) enforcement should be adopted to address these three injury mechanisms in children (Pearn, et al., 2004). For example, education pertaining to prevention could include product safety media campaigns to promote the safe use of products. Prevention initiatives aligned with the ergonomic, engineering and design approach could be conducted through the provision of product standards. Enforcement could occur through product regulations such as bans and mandatory standards.

Long-term recommendations

In the long term, a proactive approach can be used to identify product safety issues including new emerging hazards. Several long-term recommendations to utilise a proactive approach in injury data analyses for product safety initiatives are outlined below:

Firstly, regular monitoring of injury data should be conducted in order to track patterns and changes in product-related injuries. This can be done at the state and national level depending on the type of injury data sources. Regular monitoring of hospital admission data can be conducted using the National Hospital Morbidity Database, a compiled dataset from all Australian's states and territories (Australian Institute of Health and Welfare, 2013a). However, this is limited to only coded data which means causality analyses may be difficult. Currently, with the limited coverage of ED-based injury surveillance data collection in Australia, regular monitoring using ED-based injury surveillance data can be done in some states where ED-based injury surveillance units are available (i.e. Victoria and Queensland). Injury data can also be extracted from the National Non-admitted Patient Emergency Department Care Database (NAPEDCD) which is a nationwide compilation of emergency department data supplied by all Australian state and territory health departments (Australian Institute of Health and Welfare, 2013b). However, this dataset does not contain injury specific data items that are normally collected for ED-based injury surveillance data, and while text narrative data can be requested at a state and territory level, the availability of such data varies by state. Mortality data are also available at the national level that can be used to monitor product-related deaths.

In the long run, recommendations can also be made to collaborate with the Australian Federal Department of Health to instigate a national ED-based injury surveillance system. The establishment of such a system was successfully undertaken in the US, through the collaboration of the CPSC and hospitals to run the NEISS system. However, a similar system in Australia may be costly and labour intensive to implement.

Findings from regular proactive injury data monitoring should be considered in national strategic planning for product safety initiatives. In the latest product safety business plan document, the first objective of the product safety system is to identify significant product hazards in a timely, effective, efficient and transparent manner, which includes the effective management of information sources and the identification of growing areas of concern (Australian Competition & Consumer Commission, 2012). The findings and techniques proposed in this study can accommodate these goals.

Furthermore, this study also proposes that the three prioritisation criteria: frequency, severity and product causality should be used as indicators in the prioritisation of product safety issues using information from injury data. The frequency of product-related injuries can be obtained by identifying related injuries using product codes. The severity of product-related injuries can be assessed using a range of severity measures available in the data and/or can be mapped to other severity measures such as RAPEX severity ratings. However, as previously mentioned, the RAPEX severity classifications should be adjusted to align with injury classifications. The causality of product-related injuries can be determined using the product involvement factor through text narrative review. The categorisation of product involvement factor should be reviewed through blind coding, allowing statistical analysis to minimise the subjectivity of coding. This process can be labour intensive; however data mining techniques can also be developed as a substitute for the manual review work. This approach has been previously studied in Europe to automatically code injuries using the product involvement factors. However, there was no further work to improve, maintain and run the system.

In the process of interrogating injury data to prioritise product safety issues, the mechanism of product-related injuries should be used rather than the product type. In doing so, inherent hazards relating to various products within a specific mechanism may be more readily identified and addressed, without the risk of overlooking other products, which pose the same or similar inherent hazard/s. This will enable a more proactive prevention approach. This recommendation is aligned with the Product Safety Framework that has been developed by Standards Australia (Standards Australia, 2008). The framework uses safety requirements to inform standards which are then applied to multiple products based on the type/s of inherent hazard (e.g. mechanical, chemical, thermal, biological and drowning).

8.6.2 Injury Data Custodians & Health Classification Administrator

In addition to the recommendations to the product safety regulators, several recommendations are addressed at injury data custodians and administrators for the improvement of the utility of injury data for product safety purposes.

Firstly, in order to ensure the product codes classification is kept up-to-date, a system to prompt the data administrator for products which do not yet have a pre-existing code in the injury classification should be created. The system would require a ‘new product code’ to be appended as a placeholder upon data entry. Subsequently, a text narrative review of products with the ‘new product code’ placeholder should be undertaken to generate new product-specific codes for each unique product. This is similar to the approach used by the CPSC’s NEISS where a specialised code is assigned if there is no current product code available.

Secondly, the quality of injury text descriptions can be improved to inform product involvement in the injury event. This may be through the design of structured systems to collect necessary data elements. Better documentation of product involvement should also be promoted amongst clinicians including emergency staff. Furthermore, clinical staff engagement in product safety reporting processes should be encouraged and feedback to clinicians on common areas of concern should be provided.

8.7 CONCLUSION

This research has used a proactive approach of injury data analysis to interrogate the ED-based injury surveillance and hospital admission data in Queensland to improve product safety information and to prioritise product safety issues based on the injury data analyses. The studies focussed on examining product-related injuries in children aged 0 – 17 years.

Injury data are not currently being used in Australia to their full advantage to support the efficiency, effectiveness and responsiveness of the product safety system due to the complexity of their structure and the limitations in classification system/s used in injury data. This study provides methodologies for interrogating injury data to improve the proactive prevention of product-related injuries and provides methodology recommendations for the injury data to be used more effectively for product safety purposes.

Several short term and long term recommendations were made to the product safety regulators in Australia. These recommendations included methods to use injury data in product risk assessment processes as well as methods to identify product safety priorities based on injury data analyses. Several recommendations for the improvement of injury data collection in Australia were made to the injury data custodians and health classification administrators. These recommendations were proposed to improve the usability of injury data for product safety purposes.

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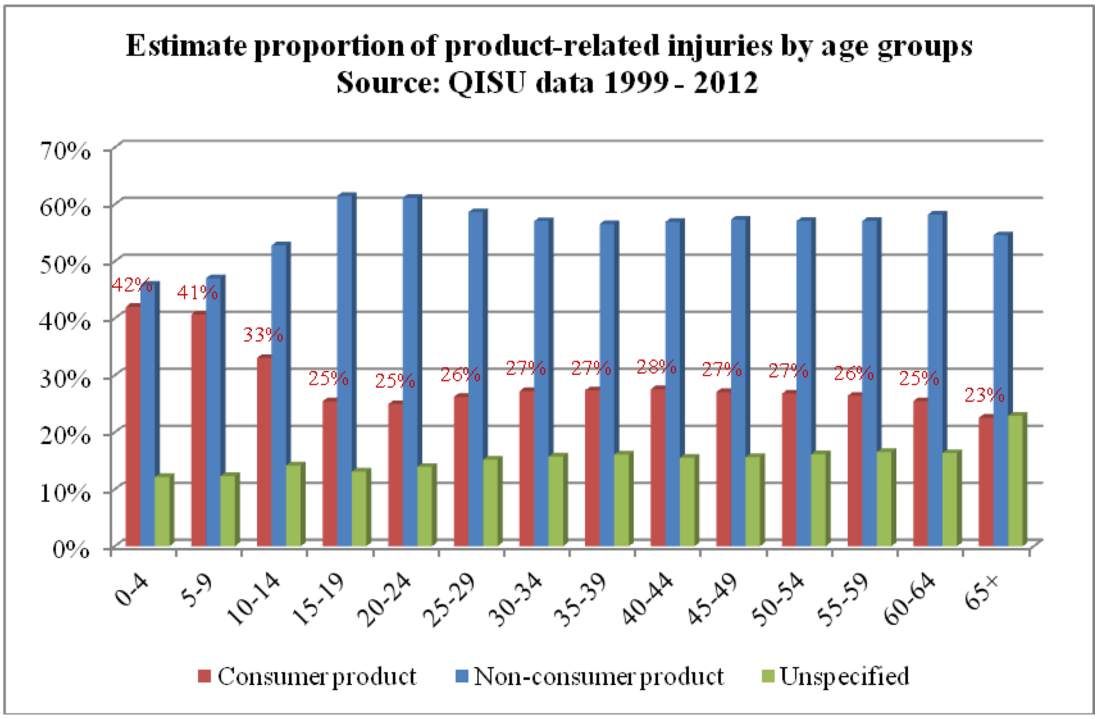
Appendices

Appendix 1: Overview of product-related injuries based on age QISU data 1999 – 2012



Appendix 2: NDS-IS Data Items

Data field	Variable Definition	Concept Definition	Type
QISU reference ID	Case identifier	A unique number assign to a injury case (presentation).	Number
Attend date	Attending date	Date of the attendance by the person to the place at which QISU data are being collected.	Date
Attend time	Attending time	Time of day of attendance by the person to the place at which QISU data are being collected.	Time
UR number	Patient identifier	A unique number assign to a patient	Number
Date birth	Date of birth	The date of birth of the injured person.	Date
Age	Age	The age of the injured person.	Number
Age group	Age group		Number
Gender code	Code for gender	The sex of the person.	Code
Gender definition	Definition of code for gender		Text definition
Mechanism of injury code	Code for injury mechanism	The way in which injury was sustained.	Code
Mechanism of injury definition	Definition of code for injury mechanism		Text definition
Part of place code	Code for part of place	The part of the specific place at which the person was situated when injured .	Code
Part of place definition level1	Defintion of code for part of place - type		Text definition
Part of place definition level2	Definition of code for part of place - subtype		Text definition
Occupation	Occupation of the injured patient	The current occupation of the person is the current job or duties which the person is principally engaged in.	Text
Post code	Postcode	The postcode of usual residence as stated by the person.	Number
Injury date	Date of injury DD MM YYYY	Date on which injury occured. If injury had gradual onset, then the date on which it was first noticed.	Date
Injury time	Time of injury HH MM	Time of day when injury occured or was first noticed.	Time
Intent code	Code for intention of the injury	Intent is the role of human intent in the occurence of the injury as assessed by the treating practitioner.	Code
Intent definition	Definition of code for intention of injury		Text definition
Type of place code	Code for place of injury occurence (maps to ICD 9-CM & ICD-10)		Code
Type of place definition level1	Definition of code for place of injury occurence - type	Place of injury is the type of place at which the person was situated when injured.	Text definition
Type of place definition	Definition of code for	The specific type of place at w	Text

Data field	Variable Definition	Concept Definition	Type
level2	place of injury occurence - subtype	hich the person was situated when injured	definition
Icd code	Code for principal diagnosis of healthcare attendance	The diagnosis chiefly responsible for occasioning the attendance of the person at the health care facility, as assessed at the time of data collection.	Code
Icd definition	Definition of code for principal diagnosis of healthcare attendance		Text definition
Nature of injury code	Code for nature of injury	The nature of the injury chiefly responsible for occasioning the attendance of the person at the health care facility.	Code
Nature of injury definition	Defintion of code for nature of injury		Text definition
Body regions code	Code for body region of injury	The bodily location of the injury chiefly responsible for occasioning the attendance of the person at the health care facility.	Code
Body regions definition	Defintion for body region of injury		Text definition
Injury description	Narrative description of injury event		Text narrative
Activity code	Code for activity when injured (maps to ICD-10)		Code
Activity definition level1	Definition of code for activity when injured - type	The type of activity being undertaken by the person when injured	Text definition
Activity definition level2	Definition of code for activity when injured - subtype	The specific type of activity being undertaken by the person when injured.	Text definition
Triage code	Code for triage score	Triage score is the urgency of the person's need for medical and nursing care.	Code
Triage definition	Definition of code for traige score		Text definition
Language code	Code for preferred language	The languange (including sign language) most preferred by the person for communication. This may be a language other than English even where the person can speak fluent English.	Code
Language definition	Definition of code for preferred language		Text definition
Aboriginality code	Code for aboriginality status	Aboriginality of person according to the Commonwealth/Australiab Bureau of Statistics 'working definition': An Aboriginal or Torres Strait Islander is a person of Aboriginal or Torres Strait Islander descent who identifies as Aboriginal or Torres Strait Islander and is accepted as such by the community whith which he or she is associated.	Code
Aboriginality definition	Definition of code for aboriginality status		Text definition
Country code	Code for country of birth	The country in which the person was born.	Code
Country defintion	Definition code for country of birth		Text definition
Industry code			Code

Data field	Variable Definition	Concept Definition	Type
Industry definition			Text definition
Mode of separation code	Code for separation status	The status at separation of person (discharged/transfer/death).	Code
Mode of separation definition	Definition for separation status		Text definition
Employment code	Code for employment	Self-reported employement status, as defined by the categories immediately prior to the admission.	Code
Employment definition	Defintion of code for employment		Text definition
External code	Code for external cause of injury (This maps to ICD 9-CM & ICD-10)	External Cause is event, circumstance or condition associated with the occurence of injury, poisoning or violence.	Code
External definition	Definition of code for external cause of injury		Text definition
Hospital code	Code for collecting hospital	The hospital in which the person attending and QISU data are being collected.	Code
Hospital definition	Definition of code for collecting hospital		Text definition
Major injury factor code	Code for major injury factor	Type of objects and substances involved in the occurrence of injury.	Code
Major injury factor definition	Definition of code for major injury factor		Text definition

Appendix 3: NDS-IS Major Injury Factor Codes

Group Name	NDS-IS Code	Title	Product flag
01. Infants or child's product	101	Baby pram, pusher, etc	Consumer product
	102	Baby walker	Consumer product
	103	High chair	Consumer product
	104	Cot	Consumer product
	105	Change table	Consumer product
	109	Other product intended for infant/child care	Consumer product
	121	Tree house, play house	Consumer product
	122	Tricycle (child's) or other ride-on toy (excludes bicycle [0549])	Consumer product
	129	Other toy	Consumer product
	141	Flying fox	Consumer product*
	142	Monkey bar or other playground climbing apparatus	Consumer product*
	143	Slide, sliding board	Consumer product*
	144	Swing, swing set	Consumer product*
	149	Other playground equipment	Consumer product*
	199	Other or unspecified infant's or child's product	Consumer product
02. Furnishing	201	Bed (excludes bunk bed [0202], cot [0104])	Consumer product
	202	Bunk bed	Consumer product
	203	Bedding (Sheets, Blankets, etc)	Consumer product
	219	Cabinet, rack, room divider, shelf	Consumer product
	229	Chair, stool (excludes step stool [0711])	Consumer product
	239	Sofa, couch, lounge, divan, etc	Consumer product
	249	Table, desk, bench, etc	Consumer product
	259	Rug, mat, loose carpet	Consumer product
	299	Other or unspecified furnishing	Consumer product
03. Appliance	301	Electric kettle or jug	Consumer product
	302	Cooking appliance (includes stove, oven, cook-top, BBQ)	Consumer product
	319	Heating appliance (includes space-heater, electric radiator, slow-combustion heater)	Consumer product
	329	Refrigerator, freezer	Consumer product
	339	Iron, other heated clothes pressing appliance (steam, other)	Consumer product
	349	Washing machine	Consumer product
	359	Television	Consumer product
	399	Other or unspecified appliance	Consumer product
04. Utensil or container	409	Knife	Consumer product
	419	Cutlery, food preparation utensil (excludes knife [0409])	Consumer product
	420	Scissors	Consumer product
	421	Drinking glass	Consumer product
	439	Clothesline, clothes drying rack, clothes horse	Consumer product
	459	Waste container, rubbish basket, refuse bin	Consumer product
	491	Grocery or shopping trolley	Consumer product
	499	Other or unspecified utensil or container	Consumer product
05. Transport (includes mobile machinery)	509	Passenger car or station wagon, people mover	Other regulator
	511	Ag-bike	Consumer product
	519	Motorcycle or sidecar, other or unspecified	Other regulator
	521	Truck or goods van (3 tonnes or more)	Other regulator
	522	Light truck, utility, van (<3 tonnes)	Other regulator
	539	Bus (10 seats or more)	Other regulator
	545	Wheelchair	Consumer product
	548	Non-motorised scooter	Consumer product
	549	Bicycle	Consumer product
	559	Trailer or horse float	Other regulator
	567	Boat	Other regulator
	568	Jet Ski	Other regulator
	569	Train or tram	Other regulator

Group Name	NDS-IS Code	Title	Product flag
	571	Tractor	Other regulator
	572	Harvesting machine	Consumer product
	573	Auger	Consumer product
	574	Slasher	Consumer product
	575	Fork lift or lift truck	Other regulator
	576	Lawn mower (power or manual)	Consumer product
	579	Mobile machinery other or unspecified	Consumer product
	589	Vehicle part, fitting or accessory	Consumer product
	599	Other or unspecified transport	Other regulator
06. Sporting equipment	601	Ball	Consumer product
	609	Other sporting projectile (eg. javelin, discus, puck, shuttlecock)	Consumer product
	611	Fish hook	Consumer product
	629	Bat, racquet, hockey stick, etc	Consumer product
	649	Object/structure on or near playing area (eg goal post, boundary fence)	Consumer product
	699	Other or unspecified sporting equipment	Consumer product
07. Tool	701	Nail, screw, carpet tack, drawing pin, etc	Consumer product
	711	Ladder, movable steps (incl. step stool)	Consumer product
	712	Scaffolding	Consumer product
	721	Hand tool: hammer (includes sledge, mallet, etc)	Consumer product
	722	Hand tool: chopping (eg hatchet, axe)	Consumer product
	723	Hand tool: cutting (eg. saw, chisel, plane)	Consumer product
	724	Hand tool: lifting (eg. jack, hoist)	Consumer product
	731	Power tool: nail gun or stud driver	Consumer product
	732	Power tool: grinder, buffer, polisher	Consumer product
	733	Power tool - drill	Consumer product
	741	Powertool: chain saw	Consumer product
	742	Powertool: circular saw	Consumer product
	749	Powertool: other or unspecified	Consumer product
	751	Shearing plant	Consumer product
	752	Dairy/milking plant	Non-product
	753	Press (excludes printing press [0799])	Consumer product
	759	Fixed plant/machinery other or unspecified	Consumer product
	761	Welding equipment	Consumer product
	764	Hose	Consumer product
	799	Other or unspecified tool/ spanner/pliers, etc	Consumer product
08. Natural object or animal	801	Tree (includes branch, stick, twig)	Non-product
	802	Plant (excludes tree [0801])	Non-product
	811	Climatic factor (eg. wind rain, snow, sunshine)	Non-product
	821	Natural surface (includes irregularity, such as pothole, ditch)	Non-product
	830	Tick	Non-product
	831	Bee, wasp	Non-product
	832	Dog	Non-product
	833	Horse	Non-product
	834	Reptile/Other (e.g. snake)	Non-product
	835	Spider	Non-product
	836	Cattle	Non-product
	837	Sheep	Non-product
	839	Jelly Fish/Marine Stinger	Non-product
	840	Fish	Non-product
	841	Person	Non-product
	899	Other or unspecified natural object or animal	Non-product
09. Food, drink, personal use item	901	Hot oil or fat	Consumer product
	902	Food; cold non-alcoholic beverage	Non-product
	903	Alcohol (beverage)	Non-product

Group Name	NDS-IS Code	Title	Product flag
	904	Hot beverage (eg tea, coffee, soup)	Non-product
	921	Footwear (includes sporting or industrial shoe or boot)	Consumer product
	929	Other clothing	Consumer product
	941	Jewellery	Consumer product
	942	Coin	Consumer product
	943	Pen, pencil	Consumer product
	999	Other or unspecified food, drink, or personal use item	Consumer product
10. Chemical substance	1001	Moth repellent (includes naphthalene, camphor)	Consumer product*
	1002	Petrol, other petroleum distillate (eg kerosene, diesel, fuel oil, white spirit)	Consumer product*
	1003	Dishwasher detergent	Consumer product
	1004	Soap, detergent, cleaning compounds (excludes dishwasher detergent	Consumer product
	1005	Paint, paint thinner (includes turpentine), paint stripper	Consumer product
	1006	Bleach, caustic (includes ammonia)	Consumer product
	1007	Carbon monoxide	Non- product
	1008	Pesticide, insecticide, herbicide	Other regulator
	1011	Acid	Consumer product
	1049	Other or unspecified chemical substance (excludes drug, medication [1099])	Consumer product*
	1050	Antihistamine	Other regulator
	1051	Aspirin, aspirin compound	Other regulator
	1052	Paracetamol, paracetamol compound	Other regulator
	1053	Sedative, tranquilliser, psychotropic	Other regulator
	1054	Ointment, topical medicine, liniment	Other regulator
	1055	Preparation containing iron salt	Other regulator
	1056	Essential oils	Other regulator
	1099	Other or unspecified drug or medication	Other regulator
11. Structure or fitting	1101	Toilet bowl, cistern, associated plumbing	Other regulator
	1102	Bathtub, shower	Other regulator
	1121	Door (includes sill, frame, etc; excludes glass door	Other regulator
	1122	Glass door	Other regulator
	1123	Window (includes sill, frame, etc)	Other regulator
	1124	Floor	Other regulator
	1125	Wall	Other regulator
	1141	Fence, gate	Other regulator
	1161	Handrail, railing, banister	Other regulator
	1188	Ceiling fan	Other regulator
	1189	Electrical fixture (includes wiring system)	Other regulator
	1199	Other or unspecified structure or fixture (steps/stairs including escalator)	Other regulator
12. Material (not part of structure or of uncertain origin)	1209	Rock, stone, gravel, etc.	Non- product
	1219	Brick, concrete, concrete block	Non- product
	1229	Wood: timber, board, splinter, etc	Non- product
	1239	Metal: sheet, part, piece. Etc.	Possible product
	1249	Glass: sheet, piece, shard, etc.	Consumer product
	1299	Other or unspecified material	Possible product
13. Miscellaneous	1301	Pin, needle (excludes hypodermic needle [1302])	Consumer product
	1302	Hypodermic needle, syringe	Other regulator
	1321	Hot water	Non-product
	1322	Water (excludes hot water [1321])	Non-product
	1331	Rope or string	Consumer product
	1332	Chain	Consumer product
	1341	Fireworks	Consumer product*
	1342	Firearm	Consumer product*
	1399	Other or unspecified factor	Possible product

* Products within multiple jurisdictions, where product safety regulators have a degree of influence or interest in its distribution were included

Appendix 4: ICD-10-AM External Cause Codes (Chapter 20)

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
V10	Pedal cyclist injured in collision with pedestrian or animal	pedal cycle	pedal cycle	**Consumer product**
V11	Pedal cyclist injured in collision with other pedal cycle	pedal cycle	pedal cycle	**Consumer product**
V12	Pedal cyclist injured in collision with two- or three-wheeled motor vehicle	pedal cycle	pedal cycle	**Consumer product**
V13	Pedal cyclist injured in collision with car, pick-up truck or van	pedal cycle	pedal cycle	**Consumer product**
V14	Pedal cyclist injured in collision with heavy transport vehicle or bus	pedal cycle	pedal cycle	**Consumer product**
V15	Pedal cyclist injured in collision with railway train or railway vehicle	pedal cycle	pedal cycle	**Consumer product**
V16	Pedal cyclist injured in collision with other non-motorised vehicle	pedal cycle	pedal cycle	**Consumer product**
V17	Pedal cyclist injured in collision with fixed or stationary object	pedal cycle	pedal cycle	**Consumer product**
V18	Pedal cyclist injured in non-collision transport accident	pedal cycle	pedal cycle	**Consumer product**
V19	Pedal cyclist injured in other and unspecified transport accidents	pedal cycle	pedal cycle	**Consumer product**
V86	Occupant of special all-terrain or other motor vehicle designed primarily for off-road use, injured in transport accident	all-terrain or off-road vehicle	all-terrain or off-road vehicle, ATV (off road vehicle), snowmobile	**Consumer product**
V90	Accident to watercraft causing drowning and submersion	watercraft	boat, ship,watercraft	**Consumer product**
V91	Accident to watercraft causing other injury	watercraft	boat, ship,watercraft	**Consumer product**
V92	Water-transport-related drowning and submersion without accident to watercraft	watercraft	boat, ship,watercraft	**Consumer product**
V93	Accident on board watercraft without accident to watercraft, not causing drowning and submersion	watercraft	watercraft	**Consumer product**
V94	Other and unspecified water transport accidents	watercraft	boat, hovercraft, ship,watercraft	**Consumer product**
V95	Accident to powered aircraft causing injury to occupant	powered aircraft		**Other regulator**
V96	Accident to non-powered aircraft causing injury to occupant	non-powered aircraft	Non-powered aircraft, balloon, glider (unpowered), hang-glider, kite (carrying person)	**Consumer product**
W00	Fall on same level involving ice and snow	Ice and snow	Ice and snow	**Not product**
W01	Fall on same level from slipping, tripping and stumbling	Surfaces, person, animals, objects and other projections and indentations		**Not product**
W01.0	Fall on same level from slipping	Surface		**Non-product**
W01.1	Fall on same level from tripping	person, animals, objects and other projections and indentations		**Possible product**
W01.2	Fall on same level from stumbling			**Non-product**
W02	Fall involving ice-skates, skis, roller-skates or skateboards	ice-skates, skis, roller-skates or skateboards	skis, sled, skateboard, skates (ice) (roller)	**Consumer product**
W02.0	Fall involving roller-skates	Roller-skates	roller blades, roller-skates, rollerski, skates (in-line)(roller),	**Consumer product**
W02.1	Fall involving skateboard	Skateboard	skateboard(s),	**Consumer product**
W02.2	Fall involving water ski	Water ski	ski(s)(water), roller blades, roller-skates, rollerski,	**Consumer product***
W02.3	Fall involving snow ski	Snow ski	ski(s)(snow), ski(ing),	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
W02.4	Fall involving snow board	Snow board	snowboard, snow board,	**Consumer product**
W02.5	Fall involving ice-skates	Ice skates	skates (ice), ice (with skates),	**Consumer product**
W02.6	Fall involving scooter, nonpowered	Scooter, non-powered	scooter(kick)(nonpowered)	**Consumer product**
W02.7	Fall involving baby carriage	Baby carriage	stroller, pram, baby (carriage), pusher	**Consumer product**
W02.8	Fall involving baby walker	Baby walker	baby (walker)	**Consumer product**
W02.9	Fall involving other and unspecified pedestrian conveyance	Pedestrian conveyance	shopping trolley, gopher, sandboard, scooter(s)(mobility)(powered)	**Consumer product**
W05	Fall involving wheelchair	wheelchair	wheelchair (electric) (nonpowered) (powered)	**Consumer product**
W06	Fall involving bed	bed	bed	**Consumer product**
W06.0	Fall involving bunk bed	Bunk bed	bunk(middle)(top)	**Consumer product**
W06.1	Fall involving special purpose bed	Special purpose bed	bed (hospital, orthopaedic, special purpose)	**Consumer product**
W06.2	Fall involving cot	Cot	cot, crib	**Consumer product**
W06.3	Fall involving bassinet	Bassinet	baby (capsule), bed (bassinet)	**Consumer product**
W06.4	Fall involving cradle	Cradle	cradle	**Consumer product**
W06.5	Fall involving hammock	Hammock	hammock (baby)	**Consumer product**
W06.6	Fall involving conventional bed	Conventional bed	bunk bed (bottom), bed (conventional, double, king, queen, single)	**Consumer product**
W06.8	Fall involving other specified bed	Bed	bed (camp, folding, futon, loft, sofa, stretcher, waterbed)	**Consumer product**
W06.9	Fall involving unspecified bed	Bed	bed	**Consumer product**
W07	Fall involving chair	chair	chair	**Consumer product**
W07.0	Fall involving rocking chair	Rocking chair	chair (gliding, rocking)	**Consumer product**
W07.1	Fall involving folding chair	Folding chair	chair (camp, folding)	**Consumer product**
W07.2	Fall involving revolving chair	Revolving chair	chair (revolving (on castors), swivel)	**Consumer product**
W07.3	Fall involving stool	Stool	stool (on castors)(revolving)	**Consumer product**
W07.4	Fall involving high-chair	High-chair	high (on castors), high-chair (on castors)	**Consumer product**
W07.5	Fall involving bath chair	Bath chair	chair (bath, shower)	**Consumer product**
W07.6	Fall involving commode chair	Commode chair	chair (commode)	**Consumer product**
W07.7	Fall involving lift assistance chair	Lift assistance chair	chair (lift assistance, smokeydawson)	**Consumer product**
W07.8	Fall involving other specified chair	Chair	bench seat, chair (arm, bench, dining, kitchen, specified, couch, divan, lounge,sofa)	**Consumer product**
W07.9	Fall involving unspecified chair	Chair	chair	**Consumer product**
W08	Fall involving other furniture	other furniture	furniture, table	**Consumer product**
W08.0	Fall involving baby change table	Baby change table	baby change table	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
W08.1	Fall involving baby exerciser	Baby exerciser	baby (exerciser), bouncinette	**Consumer product**
W08.2	Fall involving table	Table	table	**Consumer product**
W08.8	Fall involving other specified furniture	Furniture	furniture (specified)	**Consumer product**
W08.9	Fall involving unspecified furniture	Furniture	furniture	**Consumer product**
W09	Fall involving playground equipment	playground equipment	playground equipment	**Consumer product**
W09.0	Fall involving tree house	Tree house	play house, tree house	**Consumer product**
W09.1	Fall involving flying fox	Flying fox	Flying fox	**Consumer product**
W09.2	Fall involving playground climbing apparatus	Climbing apparatus	Climbing apparatus, jungle gym, monkey bar	**Consumer product**
W09.3	Fall involving slide	Slide	slide, sliding board,	**Consumer product***
W09.4	Fall involving swing	Swing	swing (set)	**Consumer product***
W09.5	Fall involving seesaw	Seesaw	seesaw, teeter totter	**Consumer product***
W09.6	Fall involving trampoline	Trampoline	trampoline	**Consumer product**
W09.8	Fall involving other specified playground equipment	Playground equipment	Playground equipment (specified)	**Consumer product***
W09.9	Fall involving unspecified playground equipment	Playground equipment	Playground equipment	**Consumer product***
W10	Fall on and from stairs and steps	stairs and steps	escalator, ramp, stairs, step, incline, staircase	**Consumer product**
W11	Fall on and from ladder	ladder	ladder, stepladder	**Consumer product**
W12	Fall on and from scaffolding	scaffolding	scaffolding	**Consumer product**
W13	Fall from, out of or through building or structure	building or structure	balcony, bridge, building, flagpole, railing, roof, structure, tower, turret, viaduct, wall, window, floor	**Other regulator**
W16	Diving or jumping into water causing injury other than drowning or submersion	water	boat, water, bottom (water), diving board, wall of swimming pool, water surface	**Possible product***
W16.9	Other and unspecified contact when diving or jumping into water causing injury other than drowning or submersion	-	in water	**Possible product**
W17	Other fall from one level to another	-	dock, embankment, haystack, high place, machine, stationary vehicle (not alighting/boarding etc), canyon, cavity, hole, manhole, opening in surface, pit, quarry, shaft, storm drain, tank, well,	**Non-product**
W17.4	Fall into empty swimming-pool	Swimming-pool	hot tub (empty), jacuzzi (empty), spa (empty), swimming pool (empty)	**Consumer product***
W17.8	Other specified fall from one level to another	-	dock, embankment, haystack, high place, machine, stationary vehicle (not alighting/boarding etc), canyon, cavity, hole, manhole, opening in surface, pit,	**Non-product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
			quarry, shaft, storm drain, tank, well,	
W17.9	Unspecified fall from one level to another	-	1 level to another, high place,	**Other regulator**
W18	Other fall on same level	-	object (stationary), toilet, bathtub,	**Other regulator**
W18.0	Fall from bumping against object	object	object (with fall)	**Possible product**
W18.1	Fall from or off toilet	Toilet	Toilet	**Other regulator**
W18.2	Fall in or into bath-tub or shower	Bath-tub or shower	Bath-tub, shower	**Other regulator**
W18.9	Unspecified fall on same level	-	fall (same level)	**Possible product**
W19	Unspecified fall	-	object (edged, pointed, or sharp with cut)	**Possible product**
W20	Struck by thrown, projected or falling object	object	cave-in (without asphyxia), building, structure, earth material (without asphyxia), earth (without asphyxia), rock, stone, timber, tree, vehicle (stationary, falling from jack, hydraulic lift, ramp)	**Consumer product**
W21	Striking against or struck by sports equipment	sports equipment	arrow, dart, sports equipment, ball, hockey stick or puck	**Consumer product**
W21.0	Striking against or struck by bat and racquet	Bat and racquet	bat, club, hockey (stick), racquet	**Consumer product**
W21.1	Striking against or struck by ball	Ball	ball, hockey (puck)	**Consumer product**
W21.2	Striking against or struck by object or structure on or near sports area	net, net pole, rugby pole or goal post	sport equipment (fixed)	**Consumer product**
W21.8	Striking against or struck by other specified sports equipment	Sports equipment	Sports equipment (specified)	**Consumer product**
W21.9	Striking against or struck by unspecified sports equipment	Sports equipment	Sports equipment	**Consumer product**
W22	Striking against or struck by other objects	object	object (stationary), carpet, curb, rug, small object	**Consumer product**
W23	Caught, crushed, jammed or pinched in or between objects	object	folding object, sliding door and door frame, washing machine wringer, packing crate, door (building)	**Consumer product**
W23.8	Caught, crushed, jammed or pinched in or between other objects	object	folding object, object (moving) (stationary and moving), washing machine wringer, under packing crate (due to losing grip), between object	**Consumer product**
W24	Contact with lifting and transmission devices, not elsewhere classified	lifting and transmission devices	lifting device, transmission device, escalator, chain hoist, conveyor belt, crane, derrick, drive belt, elevator (building), forklift (truck), hoist (chain, shaft), lift or lifting (devices, shaft), oil derrick, transmission, pulley (block, transmission), rope (lifting or	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
			transmission device), shaft (hoist, lift, transmission), transmission device (belt, cable, chain, gear, pinion, pulley, shaft), winch, wire (for lifting and transmission devices),	
W25	Contact with sharp glass	sharp glass	glass (broken, sharp)	**Consumer product**
W25.0	Contact with glass window	glass window	windouw (louvre)	**Other regulator**
W25.1	Contact with glass door	glass door	door (panel), door (fixed(kitchen fittings)	**Other regulator**
W25.2	Contact with glass shower and bath door	glass shower and bath door	glass (shower and bath), partition (shower and bath), screen (shower and bath)	**Other regulator**
W25.3	Contact with glass skylight and glass roof panels	glass skylight and glass roof panels	roof panel, skylight	**Other regulator**
W25.4	Contact with glass or mirrored glass furniture	glass furniture	glass (furniture, glass-topped coffee/dining table)	**Consumer product**
W25.6	Contact with drinking glass and glass containers	drinking glass and glass containers	glass (drinking, jar)	**Consumer product**
W25.7	Contact with mirror	mirror	mirror	**Consumer product**
W25.81	Contact with decorative glass items	Decorative glass items (e.g. ornament, vase)	ornament, decorative item	**Consumer product**
W25.82	Contact with glass partition, not elsewhere classified	-	partition	**Other regulator**
W25.89	Contact with other specified sharp glass, not elsewhere classified	Sharp glass (e.g. glass light fitting)	glass (light fitting, specified)	**Consumer product**
W25.9	Contact with unspecified sharp glass, not elsewhere classified	Sharp glass (e.g. glass light fitting)	glass	**Consumer product**
W26	Contact with knife, sword or dagger	knife, sword or dagger	bayonet, dagger, knife, sword	**Consumer product**
W27	Contact with nonpowered hand tool	nonpowered hand tool	axe, opener, chisel, drill (nonpowered), fork, garden fork, handsaw, hand tool (not powered), hoe, ice pick, lawnmower (unpowered), needle, paper-cutter, pitchfork, plane (metal, wood), rake, saw, scissors, screwdriver, sewing machine (not powered), shears (hand), shovel, spade, tool	**Consumer product**
W28	Contact with powered lawnmower	powered lawnmower	lawnmower (powered, ridden)	**Consumer product**
W29	Contact with other powered hand tools and household machinery	other powered hand tools and household machinery	other powered hand tools and household machinery	**Consumer product**
W29.0	Contact with powered grinder	Powered grinder	angle grinder, grinder, powered (meat (domestic), specified), slicer (domestic)	**Consumer product**
W29.1	Contact with powered saw	Powered saw	circular saw, saw (powered), saw (hand), jigsaw (powered)	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
W29.2	Contact with chainsaw	Chainsaw	chain (saw)	**Consumer product**
W29.3	Contact with powered nail gun	Powered nail gun	staple gun (powered), stud driver	**Consumer product**
W29.4	Contact with welding equipment	Welding equipment	welder	**Consumer product**
W29.5	Contact with powered drill	Powered drill	drill (powered)	**Consumer product**
W29.6	Contact with electric knife	Electric knife	electric (knife)	**Consumer product**
W29.8	Contact with other specified powered hand tools and household machinery	Powered hand tools, household machinery	blender, ca opener (powered), drier/dryer(clothes)(powered)(spin), electric (beater, fan, mixer), garden cultivator (powered), graden tool (powered), hand tool (powered specified), hedge-trimmer (powered), household appliance powered (specified), polisher (powered), sander, sewing machine (electric)(powered), shears hand (domestic), spin-drier	**Consumer product**
W29.9	Contact with unspecified powered hand tools and household machinery	Powered hand tools, household machinery	do-it-yourself tool (powered), hand tool (powered)	**Consumer product**
W31	Contact with other and unspecified machinery	other and unspecified machinery	other and unspecified machinery	**Consumer product**
W31.1	Contact with metalworking machinery	Metalworking machinery	abrasive wheel, metalworking, forging machine, drilling matela industrial, rolling mill, metal, overhead plane metalworking, radial saw, sawing machine (metal)	**Consumer product**
W31.2	Contact with woodworking and forming machinery	Woodworking and forming machinery	band-saw (industrial), bench-saw (industrial), woodworking, overhead plane, compound saw, industrial sander, bench/band saw (industrial)	**Consumer product**
W31.9	Contact with unspecified machinery	Machinery	motor, machine, recretional machinery	**Consumer product**
W34	Discharge from other and unspecified firearms	other and unspecified firearms	gunshot, firearm missle, flare, Very pistol, firearm discharge,airgun, bbgun, firearm NEC, pellet, flare (gun)	**Other regulator**
W34.1	Accidental air rifle discharge	air rifle	air gun, air, gas or spring actuated long , BB, paintball, pellet	**Other regulator**
W35	Explosion and rupture of boiler	boiler	boiler, hot water heater, tank (in machinery)	**Consumer product**
W36	Explosion and rupture of gas cylinder	gas cylinder	aerosol can, air tank (compressed) (in machinery), cylinder or pressure tank (in machinery), gas tank	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
			(in machinery)	
W37	Explosion and rupture of pressurised tyre, pipe or hose	pressurised tyre, pipe or hose	pressure, pressurized (hose, pipe, tire), steam or water lines (in machinery), vehicle tire NEC	**Consumer product**
W38	Explosion and rupture of other specified pressurised devices	other specified pressurised devices	pressure vessel, pressure, pressurized (cooker, vessel in machinery, device)	**Consumer product**
W39	Discharge of firework	firework	firework	**Consumer product***
W40	Explosion of other materials	-	explosive material. Acetylene, anesthetic gas in operating theatre, blasting (cap) (materials), butane, coal gas, detonator, dump , (munitions), dynamite, factory (munitions), fire-damp, gasoline (fumes) (tank) not in moving motor vehicle, grain store, grenade NEC, methane, missile NEC, propane, shell (artillery) NEC, stove (oil)	**Consumer product**
W41	Exposure to high-pressure jet	high-pressure jet	high-pressure jet (hydraulic) (pneumatic)	**Consumer product**
W44	Foreign body entering into or through eye or natural orifice	foreign body	Dust, Liquid (noncorrosive), food any type	**Consumer product**
W45	Foreign body or object entering through skin	foreign body	cutting or piercing instrument, arrow, can lid, dart, edge of stiff paper, lathe (metalworking) (woodworking) turnings, nail, paper (as sharp object), splinter, tin can lid, wood slivers	**Consumer product**
W45.0	Body piercing	Body piercing	body piercing (rings) (studs) (voluntary)	**Consumer product**
W45.9	Foreign body or object entering through skin	Foreign body	cutting or piercing instrument, can lid, arrow (not thrown, projected or falling), dart (not thrown, projected or falling), edge of stiff paper, turnings lathe, nail, paper, splinter, tin can lid, wood silvers, skin	**Consumer product**
W46	Contact with hypodermic needle	hypodermic needle	hypodermic needle	**Consumer product***
W65	Drowning and submersion while in bath-tub	bathtub	hot tub	**Consumer product***
W65.0	Drowning and submersion while in bath-tub	Bath-tub	bathtub	**Consumer product**
W65.1	Drowning and submersion while in indoor spa, Jacuzzi and hot tub	Spa, jacuzzi and hot tub	Spa, jacuzzi and hot tub (indoor)	**Consumer* product**
W66	Drowning and submersion following fall into bath-tub	bath-tub	hot tub	**Consumer product***
W66.0	Drowning and submersion following fall into bath-tub	Bath-tub	bathtub (following fall)	**Consumer product***

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
W66.1	Drowning and submersion following fall into indoor spa, Jacuzzi and hot tub	Spa, jacuzzi and hot tub	Spa, jacuzzi and hot tub (following fall)	**Consumer product***
W67	Drowning and submersion while in swimming-pool	swimming pool	pool (swimming) (wading)	**Consumer product***
W67.0	Drowning and submersion while in swimming pool	Swimming pool	swimming pool (in)	**Consumer product***
W67.1	Drowning and submersion while in outdoor spa, Jacuzzi and hot tub	Spa, jacuzzi and hot tub	Spa, jacuzzi and hot tub (in)	**Consumer product***
W68	Drowning and submersion following fall into swimming-pool	swimming pool	pool (swimming) (wading), swimming pool	**Consumer product***
W68.0	Drowning and submersion following fall into swimming-pool	Swimming pool	swimming pool (following fall)	**Consumer product***
W68.1	Drowning and submersion following fall into outdoor spa, Jacuzzi and hot tub	Spa, jacuzzi and hot tub	Spa, jacuzzi and hot tub (outdoor)(following fall)	**Consumer product***
W75	Accidental suffocation and strangulation in bed	bed	bed linen, blanket, bed, cot, cradle, baby carriage, perambulator, person, pillow, sheet (plastic)	**Consumer product**
W76	Other accidental hanging and strangulation	-	bib, other person	**Consumer product**
W80	Inhalation and ingestion of other objects causing obstruction of respiratory tract	object	mucus, phlegm, foreign body, material	**Consumer product**
W80.0	Inhalation and ingestion of other objects causing obstruction of respiratory tract - Coin	Coin	Coin	**Consumer product**
W80.1	Inhalation and ingestion of other objects causing obstruction of respiratory tract - Toy	Toy	toy (part)	**Consumer product**
W80.2	Inhalation and ingestion of other objects causing obstruction of respiratory tract - Battery	Battery	Battery	**Consumer product**
W80.8	Inhalation and ingestion of other objects causing obstruction of respiratory tract - Other specified object	object	mucus, phlegm, vomitus, specified object	**Consumer product**
W80.9	Inhalation and ingestion of other objects causing obstruction of respiratory tract - unspecified object	object	object (unspecified)	**Consumer product**
W83	Other specified threats to breathing	-	plastic bag	**Consumer product**
W84	Unspecified threat to breathing	-	person	**Consumer product**
W86	Exposure to other specified electric current	electric current	current of electric motor, lawnmower (powered) (ridden) causing electrocution, electric (current) appliance (faulty), electric conductor (faulty), electric control apparatus (faulty), electric power generating plant distribution station, electric live rail, eletric motor (faulty), electric (current) third rail, electric transformer (faulty), electric appliance (any) (faulty)	**Consumer product**
W87	Exposure to unspecified electric current	electric current	electric current	**Consumer product**
W89	Exposure to man-made visible and ultraviolet light	man-made visible and ultraviolet light	arc lamps, light sources, man-made visible light, ultraviolet (light) (man-made), welding	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
			arc torch or light	
W92	Exposure to excessive heat of man-made origin	man made heat	heat man-made, man-made conditions (except on boat ship or watercraft), infrared (heaters and lamps), welding arc torch or light	**Consumer product**
W93	Exposure to excessive cold of man-made origin	man made cold	dry ice, liquefied gas, liquid air hydrogen nitrogen, deep-freeze unit or refrigerator, excessively cold substance man-made, liquid air hydrogen nitrogen	**Consumer product**
X00	Exposure to uncontrolled fire in building or structure	building or structure	clothes clothing with conflagration, building burning (uncontrolled fire), structure burning (uncontrolled fire), fittings or furniture (in building or structure) (uncontrolled),	**Consumer product**
X02	Exposure to controlled fire in building or structure	building or structure	building or structure (controlled), brazier (in building or structure), fireplace, furnace or stove (charcoal) (coal) (coke) (electric) (gas) (wood), fire stove	**Consumer product**
X03	Exposure to controlled fire, not in building or structure	-	bonfire campfire (controlled), trash fire (controlled), brazier (not in building or structure)	**Consumer product**
X04	Exposure to ignition of highly flammable material	highly flammable material	highly flammable material (benzine) (fat) (gasoline) (kerosene) (paraffin) (petrol), highly flammable material, apparel from highly flammable material, gasoline, kerosene, paraffin, petrol	**Consumer product**
X05	Exposure to ignition or melting of nightwear	nightwear	nightwear (gown, nightclothes, nightdress, pajamas, robe)	**Consumer product**
X06	Exposure to ignition or melting of other clothing and apparel	clothing and apparel	clothes clothing (from controlled fire), apparel, jewelry (plastic)	**Consumer product**
X08	Exposure to other specified smoke, fire and flames	-	bed, bed linen, blowtorch, candle, cigar or cigarette, lamp (flame), lighter (cigar) (cigarette), matches, mattress, pipe (hot) smoking, torch welding, bed (bed clothes) (bed linen) (mattress) (pillows) (sheets) (spreads)	**Consumer product**
X09	Exposure to unspecified smoke, fire and flames	smoke, fire, flames	fire resulting from lightning, smoke, fire, flames	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
X10	Contact with hot drinks, food, fats and cooking oils	hot drinks, food, fats and cooking oils	drink, fat, food, oil (cooking)	**Non-product**
X10.0	Contact with hot drink	Hot drink	drink (hot)	**Non-product**
X10.1	Contact with hot food	Hot food	food (hot)	**Non-product**
X10.2	Contact with hot fat and cooking oil	hot fat and cooking oil	fat and cooking oil (hot)	**Non-product**
X11	Contact with hot tap-water	hot tap water	water (bath) (bucket) (from hose) (tap) (tub), tapwater (from hose or tap) (in bath, bucket or tub)	**Non-product**
X11.1	Contact with contained hot tap-water	Contained hot tap-water	Contained hot tap-water	**Non-product**
X11.8	Contact with other specified hot tap-water	Hot tap-water	hot tap water (specified)	**Non-product**
X11.9	Contact with unspecified hot tap-water	Hot tap-water	hot tap water (unspecified)	**Non-product**
X12	Contact with other hot fluids	hot fluids	hot fluid, hot liquid, hot water heated on stove, liquid (boiling) (hot), substance (hot) boiling	**Non-product**
X13	Contact with steam and hot vapours	steam and hot vapors	steam, hot vapor	**Non-product**
X14	Contact with hot air and gases	hot air and gases	hot air, hot gases	**Non-product**
X15	Contact with hot household appliances	hot household appliances	cooker (hot), heat from appliance (electrical) (household), hot household appliance, hot kettle, hot plate, hot saucepan (glass) (metal), hot stove (kitchen), hot toaster, hotplate, iron (hot)	**Consumer product**
X15.0	Contact with hot stove, oven or cook-top	Hot stove, oven or cook-top	cook (hot), cooker, plate, stove (kitchen), hotplate, grill (as part of oven)	**Consumer product**
X15.1	Contact with hot saucepan or frying pan	Hot saucepan or frying pan	baking pan (hot), frying pan (hot), saucepan (hot)(metal)(glass)	**Consumer product**
X15.2	Contact with hot toaster	Hot toaster	toaster (hot)	**Consumer product**
X15.3	Contact with hot kettle	Hot kettle	kettle (hot)	**Consumer product**
X15.4	Contact with hot clothes iron or press	Hot clothes iron or press	clothes press, iron (hot), clothes iron	**Consumer product**
X15.5	Contact with hot barbeque	Hot barbeque	barbeque (hot)	**Consumer product**
X15.8	Contact with other specified hot household appliance	Household appliance	cafe grill, hair appliance, household appliance (specified), sandwich toaster, waffle maker	**Consumer product**
X15.9	Contact with unspecified hot household appliance	Household appliance	Household appliance	**Consumer product**
X16	Contact with hot heating appliances, radiators and pipes	hot heating appliances, radiators and pipes	electric blanket, heat from appliance (electrical) (household) heating, heating appliance radiator or pipe, hot pipe, hot radiator, heating pad (electric), electric heating apparatus,	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product-relatedness
X17	Contact with hot engines, machinery and tools	hot engines, machinery and tools	engine (hot), hot machinery, hot tool	**Consumer product**
X18	Contact with other hot metals	hot metals	hot metal (liquid) (molten)	**Consumer product**
X19	Contact with other and unspecified heat and hot substances	heat and hot substances	hot object (not producing fire or flames), hot substance	**Consumer product**
X48	Accidental poisoning by and exposure to pesticides	pesticides	*See Table of Drugs and Chemicals*	**Consumer product**
X49	Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances	other and unspecified chemicals and noxious substances	acid, vitriol, noxious substance, poisonous plants, poisonous substance, liquid corrosive, second hand tobacco smoke	**Consumer product**

* Products within multiple jurisdictions, where product safety regulators have a degree of influence or interest in its distribution were included

Appendix 5: ICECI Object/substance Producing Injury (Module C3)

Group	Code	Inclusion
1 Land vehicle or means of land transport		
1.01 Person-powered means of transport	1.01.01 Transport vehicle drawn or pushed by person	Push-cart
	1.01.05 Pedal cycle	Includes: • non-motorised mountain bike, bicycle, adult tricycle • adult unpowered tricycle, pedal cycle rickshaw • trailer for child attached to adult pedal cycle
	1.01.98 Other specified person-powered means of transport	
	1.01.99 Unspecified person-powered means of transport	
1.02 Animal-powered means of transport	1.02.01 Animal being ridden	
	1.02.05 Animal-drawn vehicle	
	1.02.98 Other specified animal-powered means of transport	
	1.02.99 Unspecified animal-powered means of transport	
1.03 Motorised two- or three-wheeled vehicle	1.03.01 Motorcycle	Includes: • motorcycle with sidecar
	1.03.05 Moped, scooter, vespa	Includes: • motorised pedal cycle • motorised bicycle
	1.03.10 Three-wheeled motor vehicle or scooter	Includes: • motor-driven tricycle (for adults) • motorised rickshaw • three-wheeled motor vehicle (eg., tuk-tuk)
	1.03.98 Other specified motorised two- or three-wheeled vehicle	
	1.03.99 Unspecified motorised two- or three-wheeled vehicle	
1.04 Light transport vehicle with four or more wheels	1.04.01 Passenger car	Includes: • station wagon • minivan carrying up to 10 people • school bus with seats for up to 10 people
	1.04.05 Light truck, Sports Utility Vehicle (SUV), utility van, 4x4 vehicle, jeep, pick-up truck	
	1.04.10 Minibus	Includes: • vehicle with 11 to 19 seats • minibus used as taxi • minibus used as schoolbus
	1.04.98 Other specified *light transport vehicle* with four or more wheels	Includes: • golf cart
	1.04.99 Unspecified *light transport vehicle* with four or more wheels	
1.05 Heavy transport vehicle with four or more wheels	1.05.01 *Bus*, coach	Includes: • vehicle with 20 or more seats • school bus with 20 or more seats
	1.05.10 Tractor-trailer, articulated lorry, 18-wheeler, rig	
	1.05.30 Heavy truck NEC	Includes: • panel truck, tow truck, dump truck, garbage truck
	1.05.60 Trailer or horse-float	
	1.05.98 Other specified *heavy transport vehicle* with four or more wheels	
	1.05.99 Unspecified *heavy transport vehicle* with four or more wheels	
1.06 Rail vehicle	1.06.01 Streetcar, tram, electric car, car trolley	
	1.06.05 Train	Includes: • diesel, electric, or steam-powered train
	1.06.10 Funicular, monorail, or other similar *rail vehicle*	
	1.06.98 Other specified *rail vehicle*	
	1.06.99 Unspecified rail vehicle	
1.07 Parts/components	1.07.01 Vehicle doors NEC	Includes:

Group	Code	Inclusion
of land vehicle or means of land transport		• “hatch”-type door
	1.07.05 Vehicle seat belts, deploying air bags	
	1.07.10 Tyre (tire) or battery (attached or unattached)	
	1.07.15 Vehicle window or windshield	
	1.07.20 Interior of vehicle	Includes: • dashboard, steering wheel, seats
	1.07.25 Engine of vehicle	Includes: • engine removed from vehicle for repairs
	1.07.98 Other specified part/component of land vehicle or means of transport	Includes: • pedal cycle chain
	1.07.99 Unspecified part/component of land vehicle or means of transport	
1.98 Other specified land vehicle or means of land transport	1.98.01 Cable car, ski chair lift, ski lift with gondola	
	1.98.05 Motorised wheelchair	Includes: • three-wheeled motorised wheelchair
	1.98.10 Small-sized motorised vehicles for children	
	1.98.15 Motor home	
	1.98.98 Other specified land vehicle or means of land transport	
1.99 Unspecified land vehicle or means of land transport		
2 Mobile machinery or special purpose vehicle		
2.01 Mobile machinery/special purpose vehicle mainly used in agriculture	2.01.01 Ride-on lawnmower	
	2.01.05 Tractor	
	2.01.10 Harvesting machine	Includes: • grain harvester, cotton harvester, sugar cane harvester, fruit and vegetable harvester, combine harvester, grape harvester • animal-powered harvesting machinery
	2.01.15 Auger, post-hole digger	Includes: • animal-powered auger or post-hole digger
	2.01.20 Equipment towed or powered by tractors NEC	Includes: • slasher, cultivating equipment, fertilizer spreader
	2.01.98 Other specified mobile *machinery* or special purpose vehicle used in agriculture	Includes: • animal-powered farm machinery • self-propelled machinery
	2.01.99 Unspecified mobile *machinery* or special purpose vehicle used in agriculture	Includes: • animal-powered farm machinery NOS
2.02 Mobile machinery/special purpose vehicle mainly used in industry	2.02.01 Forklift or lift truck	
	2.02.05 Mobile crane	
	2.02.10 Battery-powered airport *passenger* vehicle	
	2.02.15 Logging *car*	
	2.02.20 Coal-*car* in mine	
	2.02.25 Tram, truck, or tub in mine or quarry	
	2.02.98 Other specified mobile *machinery* or special purpose vehicle	
	mainly used in industry	
	2.02.99 Unspecified mobile *machinery* or special purpose vehicle mainly used in industry	
2.03 Mobile machinery/special purpose vehicle mainly used in construction	2.03.01 Grader	
	2.03.05 Front-end loader, bulldozer	
	2.03.10 Excavator, digger, mechanical shovel	
	2.03.15 Road roller	
	2.03.98 Other specified mobile *machinery* or special purpose vehicle	
	mainly used in construction	
	2.03.99 Unspecified mobile *machinery* or special purpose vehicle mainly	
	used in construction	
2.98 Other specified mobile machinery or special purpose vehicle	2.98.01 Ambulance	
	2.98.05 Fire truck, fire engine	
	2.98.10 Race car	

Group	Code	Inclusion
	2.98.15 Snowmobile, ski-scooter	
	2.98.20 Special all-terrain vehicle/off-road vehicle	Includes: • all-terrain vehicle with two, three, or four wheels • dirt bike • quad motorcycle
	2.98.98 Other specified mobile *machinery* or special purpose vehicle	
2.99 Unspecified mobile machinery or special purpose vehicle		
3 Watercraft or means of water transport		
3.01 Powered (motorised) watercraft or means of water transport	3.01.01 Merchant ship, cargo ship, oil tanker	
	3.01.05 *Passenger* ship, *passenger* liner, ocean liner	Includes: • ferry used for crossing long distances on open waters
	3.01.10 Fishing boat, trawler	
	3.01.15 Ferry used for short trips across closed waters (eg small lake	
	minor rivers)	
	3.01.20 Motorized yacht, motorboat, powered boat, personal powered *watercraft*	Includes: dingy (dinghy)/row boat/rubberduck (Zodiac) with outboard motor, jet-ski
	3.01.30 Houseboat	
	3.01.40 Hovercraft	Includes: hovercraft in use over water, land, or swamp
	3.01.50 Airboat	Includes: shallow-draft boat moved by high-mounted propeller (or jet) operating in the air. Able to cross many types of surface including swamps, water, tundra.
	3.01.60 Submarine or related craft	
	3.01.98 Other specified powered *watercraft* or means of water transport	
	3.01.99 Unspecified powered *watercraft* or means of water transport	
3.02 Unpowered watercraft or means of water transport	3.02.01 Sailboat, unpowered yacht	
	3.02.05 Canoe, kayak, row boat, pirogue, piragua	Includes: • dingy (dinghy), unpowered • inflatable raft, raft NOS
	3.02.10 Wave board, surfboard, paddle ski	
	3.02.15 Windsurfer	
	3.02.98 Other specified unpowered *watercraft* or means of water transport	
	3.02.99 Unspecified unpowered *watercraft* or means of water transport	
3.03 Part/component of watercraft (powered or unpowered)		Includes: • boarding plank • machinery on watercraft Propeller
3.98 Other specified watercraft or means of water transport		
3.99 Watercraft, unspecified as powered or unpowered, or unspecified means of water transport		
4 Aircraft or means of air transport		
4.01 Powered aircraft or means of air transport	4.01.01 Helicopter	
	4.01.05 Airship, blimp	
	4.01.10 Ultralight powered *aircraft*	
	4.01.15 Private fixed-wing powered *aircraft*	
	4.01.20 Commercial fixed-wing powered *aircraft*	
	4.01.40 Military fixed-wing powered *aircraft*	
	4.01.50 Spacecraft	
	4.01.98 Other specified powered *aircraft* or means of air transport	
	4.01.99 Unspecified powered *aircraft* or means of air transport	
4.02 Unpowered aircraft or means of air	4.02.01 *Passenger* balloon, unpowered	
	4.02.05 Parachute	

Group	Code	Inclusion
transport	4.02.10 Hang-glider	
	4.02.15 Glider	Includes: • rigid-wing glider
	4.02.98 Other specified unpowered *aircraft* or means of air transport	
	4.02.99 Unspecified unpowered *aircraft* or means of air transport	
4.03 Part/component of aircraft (powered or unpowered)		Includes: • boarding steps • machinery on aircraft • propeller
4.98 Other specified aircraft or means of air transport		
4.99 Unspecified aircraft or means of air transport		
5 Furniture/furnishing		
5.01 Bed, bedding or bedding accessories	5.01.01 Bunk bed	Includes: • base, mattress, ladder of bunk bed
	5.01.05 Special bed, orthopaedic bed, or stretcher	Includes: • hospital bed • base, mattress of special bed, orthopaedic bed or stretcher
	5.01.10 Hammock	
	5.01.15 Mattress, sleeping mat	Includes: • Air or camping mattress
	5.01.20 Other specified bed	Includes: • base, mattress • waterbed or accessories • convertible, hideaway, or sofa bed • futon
	5.01.25 Pillow, cushion	
	5.01.30 Bedrails	
	5.01.98 Other specified bedding or bedding accessories	Includes: • bed linen, sheets, slipcover, doona, quilt, duvet, blanket, sleeping bag
	5.01.99 Unspecified bedding or bedding accessories	Includes: • bed NOS
5.02 Chair, sofa	5.02.01 Upholstered chair, sofa, couch, lounge, divan	
	5.02.05 Hard chair, couch, bench	
	5.02.10 Rocking/gliding chair	
	5.02.15 Folding chair	Includes: • beach folding chair
	5.02.20 Revolving chair	Includes: • office chair
	5.02.25 Stool	Includes: • footstool, barstool, kitchen stool, ottoman, hassock
	5.02.30 Commode chair	
	5.02.98 Other specified chair, sofa	
	5.02.99 Unspecified chair, sofa	
5.03 Table, stand, cupboard, shelf or partition	5.03.01 Rack, bookshelf	
	5.03.05 Cabinet, cupboard, side board, chest of drawers, tall boy, dresser	
	5.03.10 Dining room/kitchen table, kitchen bench	Includes: • glass-topped dining table
	5.03.15 Coffee table	Includes: • glass-topped coffee table
	5.03.20 Night table, end table	
	5.03.25 Desk, workbench	
	5.03.30 Television table, stand, cupboard	
	5.03.35 Folding table	
	5.03.40 Room divider or partition	
	5.03.98 Other specified table, stand, cupboard, shelf or	

Group	Code	Inclusion
	partition	
	5.03.99 Unspecified table, stand, cupboard, shelf or partition	
5.04 Decoration, decorating item	5.04.01 Rug, mat, loose carpet	
	5.04.05 Draperies, curtains	
	5.04.10 Roller/venetian blind or indoor shutter	
	5.04.15 Window covering hardware	Includes: • rod, hook, cord, ring
	5.04.20 Mirror or mirror glass	Includes: • mounted/framed mirror
	5.04.25 Portrait, picture, picture frame, or other wall hanging or similar decoration	
	5.04.30 Ornament, bric-à-brac, knick-knack, statue, vase, urn	
	5.04.35 Christmas tree	Includes: • artificial tree • real/fresh-cut tree
	5.04.40 Holiday decorations	Includes: • fairy lights • Christmas tree decorations
	5.04.98 Other specified decoration, decorating item	Includes: • music box or chime • artificial flower or plant
	5.04.99 Unspecified decoration, decorating item	
5.98 Other specified furniture/furnishing		
5.99 Unspecified furniture/furnishing		
6 Infant or child product		
6.01 Baby or child article	6.01.01 Baby pram, buggy, pusher, stroller, carriage	
	6.01.05 Baby walker	
	6.01.10 Baby exerciser, jumper, or portable swing (*home* use)	
	6.01.15 High chair, booster seat	
	6.01.20 Baby or child car seat	
	6.01.25 Potty chair, training seat	
	6.01.30 Cot, crib, baby bed	Includes: • bassinette, basket bed • mattress or pad
	6.01.45 Playpen, travel yard	
	6.01.50 Baby gate or barrier	
	6.01.55 Baby carrier (back pack type)	
	6.01.60 Baby carrier (pedal cycle)	
	6.01.65 Baby baths or bathinettes	
	6.01.70 Changing table	Includes: • platform used to hold a baby while nappy/diaper is being changed
	6.01.75 Pacifier, dummy	
	6.01.80 Baby bottle or nipple	
	6.01.85 Diaper, nappy	Includes: • disposable or cloth diaper • disposable training pants
	6.01.90 Diaper fastener	Includes: • safety pin or other fastener
	6.01.98 Other specified baby or child article	Includes: • baby rattle • teething ring
	6.01.99 Unspecified baby or child article	
6.02 Toy	6.02.01 Tricycle (child's) or other ride-on toy	Includes: • wheeled, unpowered riding toy or go cart
	6.02.05 Toy vehicle, Tonka toy	Includes: • electric toy race car or train
	6.02.10 Toy gun or related accessory	Includes: • toy cap, cap toy, cap gun, other toy gun
	6.02.18 Other toy weapon or projectile toy	Includes: • slingshot, bow and arrow designed as toy, etc. • knife designed as toy
	6.02.20 Toy – art, craft, or kit	Includes: • building set, building blocks, Lego blocks

Group	Code	Inclusion
		• chemistry/science kit • model kit, rocket kite, or fuel-powered model • needle craft kit • plasticine, modelling clay
	6.02.25 Board game or accessory/piece	
	6.02.30 Toy *sports* equipment	Includes: • skipping rope, jump rope
	6.02.45 Ball, general, other than sport specific	Includes: • Inflatable beach ball
	6.02.50 Flying toy	Includes: • kite or kite string • Frisbee • boomerang
	6.02.55 Doll, doll accessory or part, stuffed toy	Includes: • Barbie doll, GI-Joe figurine, action figure • teddy bear
	6.02.60 Balloon (toy)	
	6.02.65 Other inflatable toy	
	6.02.70 Marble, bead	
	6.02.75 *Play* tent, tunnel, or other enclosure	
	6.02.80 Toy box or chest	
	6.02.98 Other specified toy	Includes: • part of toy NEC
	6.02.99 Unspecified toy	
6.03 Playground equipment	6.03.01 Tree house, play house	
	6.03.05 Flying fox	
	6.03.10 Monkey bar	
	6.03.18 Other *playground* climbing apparatus	
	6.03.20 Slide, sliding board	
	6.03.25 Swing, swing set	
	6.03.30 Seesaw, teeter totter	
	6.03.45 Powered amusement rides	Includes: • roller coaster • shopping mall ride
	6.03.98 Other specified *playground* equipment	
	6.03.99 Unspecified *playground* equipment	
6.98 Other specified infant or child product		
6.99 Unspecified infant or child product		
7 Appliance mainly used in household		
7.01 Cooking or kitchen appliance	7.01.01 Electric kettle	
	7.01.05 Electric frying pan, deep fryer	
	7.01.10 Electric bread making machine	
	7.01.15 Food processor, blender, juicer	
	7.01.20 Powered knife	
	7.01.25 Electric toaster, toaster oven	
	7.01.26 Microwave oven	
	7.01.30 Other electric cooking or food processing appliance	Includes: • electric griddle, electric waffle iron • slow cooker, crock pot • coffee maker, can opener (powered)
	7.01.45 Stove, oven, cooktop	Includes: • stove fueled by coal, wood, electricity, or gas
	7.01.55 Pressurised kerosene/paraffin cooking stove	
	7.01.56 Other type of kerosene/paraffin cooking stove	Includes: • low-pressure, multiwick kerosene/paraffin stove
	7.01.60 Coal pot	
	7.01.61 Chulo stove	
	7.01.65 Barbeque, Weber grill, outdoor cookers/griller, outdoor clay oven	
	7.01.70 Dishwasher	
	7.01.75 Refrigerator, freezer	
	7.01.98 Other specified cooking or kitchen appliance	
	7.01.99 Unspecified cooking or kitchen appliance	

Group	Code	Inclusion
7.02 Cleaning or laundering appliance or tool	7.02.01 Washing machine	Includes: • electric, gas or hand-operated washing machine
	7.02.05 Other specified clothes cleaning appliance	
	7.02.10 Clothes dryer	
	7.02.15 Clothes iron, press	
	7.02.16 Clothesline, clothes drying rack, clotheshorse	Includes: • mobile clotheshorse, frame for hanging clothes
	7.02.20 Cleaning tool (unpowered)	Includes: • broom, duster, mop
	7.02.25 Vacuum cleaner	
	7.02.30 Powered cleaning tool NEC	
	7.02.98 Other specified cleaning or laundering appliance or tool	
	7.02.99 Unspecified cleaning or laundering appliance or tool	
7.03 Lighting appliance	7.03.01 Free-standing gas, oil, or kerosene lamp	
	7.03.02 Electric lamp	
	7.03.05 Other specified lamp or lamp component	Includes: • internal/external gas lamp attached to main gasline • lampshade
	7.03.10 Battery-operated torch	
	7.03.15 Candle, candlestick	
	7.03.98 Other specified lighting appliance	
	7.03.99 Unspecified lighting appliance	
7.04 Heating or cooling appliance	7.04.01 Fan	Includes: • ceiling fan
	7.04.05 Electric or gas radiator, heater	Includes: • bar-radiator, oil heater
	7.04.10 Kerosene heater	
	7.04.98 Other specified heating or cooling appliance	Includes: • domestic boiler, furnace • hot water system, solar hot water system
	7.04.99 Unspecified heating or cooling appliance	
7.05 Sewing appliance or equipment	7.05.01 Sewing machine	Includes: • electric sewing machine • manual sewing machine
	7.05.05 Scissors	
	7.05.10 Pin, needle	
	7.05.98 Other specified sewing appliance or equipment	
	7.05.99 Unspecified sewing appliance or equipment	
7.06 Entertainment appliance	7.06.01 Television	
	7.06.05 Video recorder, decoder player	
	7.06.10 Video camera, camera, digital camera or accessory	
	7.06.15 Sound equipment	Includes: • hi-fi, stereo equipment, speakers
	7.06.98 Other specified entertainment appliance	
	7.06.99 Unspecified entertainment appliance	
7.98 Other specified household appliance	7.98.01 Cord of household appliance, extension cord	
	7.98.98 Other specified household appliance	
7.99 Unspecified household appliance		
8 Utensil or container		
8.01 Cooking or food processing utensil	8.01.01 Non-electric kettle	
	8.01.05 Knife NEC	Includes: • kitchen knife , Stanley knife, pocket knife
	8.01.10 Cooking pot, pan	
	8.01.15 Pressure cooker	
	8.01.20 Cutlery, food preparation utensil	Includes: • spoon, fork, chopsticks • garlic press, chopping board, potato peeler • ice pick for domestic use
	8.01.98 Other specified cooking or food processing utensil	Includes: • bottle opener
	8.01.99 Unspecified cooking or food processing utensil	
8.02 Crockery, kitchen container	8.02.01 Drinking glass, cup made from glass or china, etc.	
	8.02.05 Plate, bowl, dish made from glass or china, etc	

Group	Code	Inclusion
	8.02.10 Glass bottle or jar	
	8.02.15 Container made from plastic, wood, or clay	Includes: • plastic cup, bottle, plate, bowl
	8.02.98 Other specified crockery, kitchen container	
	8.02.99 Unspecified crockery, kitchen container	
8.03 Cleaning utensil or container	8.03.05 Bucket, pail	Includes: • nappy bucket, diaper pail
	8.03.98 Other specified cleaning utensil or container	
	8.03.99 Unspecified cleaning utensil or container	
8.04 Food storage or related utensil or container	8.04.01 Tinned container, tin can	
	8.04.05 Box or carton containing food or drink	
	8.04.10 Grocery or shopping trolley/cart	
	8.04.98 Other specified food storage or related utensil or container	
	8.04.99 Unspecified food storage or related utensil or container	
8.98 Other specified utensil or container	8.98.01 Rubbish bin, trash can, dumpster	Includes: • ”wheeliebin”
	8.98.08 Heavy container, box, package NEC	Includes: • container or box weighing more than 5 kilograms/10 pounds gross weight NEC
	8.98.18 Bag, sack NEC	
	8.98.98 Other specified utensil or container	
8.99 Unspecified utensil or container		
9 Item mainly for personal use		
9.01 Clothes, foot wear, or related products	9.01.01 Belt, braces, suspenders, sash	
	9.01.05 Button	
	9.01.10 Other specified clothes fastener	Includes: • zipper, press-stud, snap
	9.01.15 Shoe, sandal, slipper, boot	Includes: • sport shoe, hiking boot, etc.
	9.01.20 Shoelace, shoe buckle	
	9.01.25 Shirt, blouse, t-shirt, trousers, slacks, jacket, coat, outerwear	
	9.01.30 Nightclothes, pyjamas, nightwear, underwear, undergarment, lingerie	
	9.01.98 Other specified clothes, foot wear, or related product	Includes: • gloves, cap, hat, etc. • overshoe, socks
	9.01.99 Unspecified clothes, foot wear, or related product	
9.02 Clothing accessory or personal decoration item	9.02.01 Wristwatch, jewellery	
	9.02.98 Other specified clothing accessory or personal decorative item	Includes: • scarf
	9.02.99 Unspecified clothing accessory or personal decorative item	
9.03 Personal grooming utensil	9.03.01 Hair dryer, curling iron, curler	
	9.03.05 Comb, hairbrush	
	9.03.10 Razor, razor blade	
	9.03.15 Electric shaver	
	9.03.20 Electric toothbrush	
	9.03.28 Other toothbrush	
	9.03.98 Other specified personal grooming utensil	
	9.03.99 Unspecified personal grooming utensil	
9.04 Toiletries, cosmetics, or related product	9.04.01 Cleaning agent for contact lenses	
	9.04.05 Dental care products	Includes: • toothpaste (with or without fluoride) • product to clean false teeth • mouthwash
	9.04.10 Cotton swab, cotton bud, Q-Tip	
	9.04.15 Soap	Includes: • liquid soap
	9.04.20 Deodorants	
	9.04.25 Perfume, cologne	
	9.04.35 Hair colouring preparation	Includes: • peroxide
	9.04.40 Hair removal preparation, depilatory	

Group	Code	Inclusion
	9.04.43 Other hair care product	
	9.04.45 Nail polish or nail polish remover	
	9.04.50 Body or facial cream/lotion	
	9.04.55 Body powder, talc	Includes: • baby powder
	9.04.60 Cosmetics NEC	Includes: • lipstick, lip balm • eye make-up products (eg., mascara, kohl, surma)
	9.04.65 Suntan or sunscreen products, self-tan products	
	9.04.70 Essential oils, oils used in aromatherapy	
	9.04.98 Other specified toiletries or related product	
	9.04.99 Unspecified toiletries or related product	
9.05 Communication or related utensil or accessory	9.05.01 Telephone, mobile phone, cellular phone	Includes: • accessories such as charger, etc.
	9.05.05 Personal computer or related accessory	Includes: • printer, internal parts of the computer, speakers, compact disks, etc.
	9.05.10 Fax machine and other related equipment	Includes: • accessories such as toner, etc.
	9.05.11 Typewriter correction fluid	
	9.05.15 Pen, pencil	Includes: • whiteboard marker, dry-erase marker
	9.05.20 Other stationery item	Includes: • stapler, hole puncher, letter opener, pencil sharpener, etc.
	9.05.98 Other specified communication or related utensil or accessory	
	9.05.99 Unspecified communication or related utensil or accessory	
9.06 Arts and crafts supplies	9.06.01 Artist paint	Includes: • oil, acrylic, water colour
	9.06.05 Chalk, crayon	Includes: • chalk for black board
	9.06.10 Glazes	
	9.06.15 Canvas	
	9.06.98 Other specified arts and crafts supplies	
	9.06.99 Unspecified arts and crafts supplies	
9.07 Personal aid	9.07.01 Eyewear	Includes: • prescription eyewear • reading glasses • contact lenses • sunglasses
	9.07.05 Wheelchair	Includes: • wheelchair used in competitive sport
	9.07.10 Cane, walker, walking stick, walking frame	Includes: • white cane used by sight-impaired person
	9.07.15 Prosthesis	Includes: • artificial eye • pacemaker • artificial limb
	9.07.20 Rubber bathtub mat	
	9.07.98 Other specified personal aid	
	9.07.99 Unspecified personal aid	
9.08 Tobacco or related product	9.08.01 Cigarette, cigar, pipe	
	9.08.05 Lighter, match	
	9.08.10 Aids to quit smoking	Includes: • adhesive patch, chewing gum containing nicotine, etc.
	9.08.98 Other specified tobacco or related product	Includes: • Pipe tobacco, ashtray, chewing tobacco, etc.
	9.08.99 Unspecified tobacco or related product	
9.98 Other specified personal use item	9.98.01 Vaporiser, humidifier	
	9.98.05 Oil burner	
	9.98.10 Condom, or other contraceptive device	

Group	Code	Inclusion
	9.98.15 Sex aids	
	9.98.20 Alarm clock, clock	
	9.98.25 Umbrella	
	9.98.30 Coins	
	9.98.40 Hand-held fan	Includes: battery-operated fan
	9.98.98 Other specified personal use item	
9.99 Unspecified personal use item		
10 Equipment mainly used in sports/recreational activity		
10.01 Ball used in sport	10.01.01 Soft ball	Includes: • tennis ball, squash ball, football
	10.01.05 Puck, hard ball	Includes: • golf ball, cricket ball, hockey ball or puck, baseball
	10.01.98 Other specified ball	
	10.01.99 Unspecified ball	
10.02 Hand-held sports equipment	10.02.01 Spear, javelin NEC	Excludes: • spear, javelin designed as weapon (12.01.01)
	10.02.05 Bow, arrow (bow and arrow), bolt (crossbow) NEC	
	10.02.10 Other specified *sports* projectile	
	10.02.15 Bat, hockey stick	
	10.02.20 Racquet	
	10.02.25 Ice pick	Includes: aid to ice climbing
	10.02.98 Other specified hand-held *sports* equipment	
	10.02.99 Unspecified hand-held *sports* equipment	
10.03 Equipment/structure for playing sports and exercise	10.03.01 Net	Includes: • tennis net, volleyball net, soccer net
	10.03.05 Rugby pole, net pole, goal post	Includes: • pole used to support net • post to mark goal or boundary
	10.03.10 Trampoline	
	10.03.15 Gymnastic equipment	Includes: • pommel horse, balance beam, etc.
	10.03.20 Sports mat	
	10.03.25 Diving board, platform	
	10.03.30 Exercise, fitness equipment – movable (portable)	Includes: • dumbbell
	10.03.35 *Exercise*, fitness equipment – fixed	Includes: • Stairmaster • stationary pedal cycle
	10.03.88 Other specified equipment/structure for playing *sports/exercise* – moveable (portable)	
	10.03.98 Other specified equipment/structure for playing *sports/exercise* – fixed	
	10.03.99 Unspecified equipment/structure for playing sports/*exercise*	
10.04 Equipment with wheels or designed for movement, mainly for use in sports/recreational activity	10.04.01 Roller skates, rollerski, in-line skates, roller blades	
	10.04.05 Skateboard	
	10.04.10 Folding scooter	Includes: • lightweight folding scooter
	10.04.15 Waterski	
	10.04.20 Snow ski	
	10.04.25 Snow board	
	10.04.30 Ice skate	
	10.04.35 Sled, toboggan, sleigh, snow disk, snow tube	
	10.04.98 Other specified sports/recreational equipment with wheels or equipment designed for movement	
	10.04.99 Unspecified sports/recreational equipment with wheels or equipment designed for movement	
10.05 Underwater diving equipment	10.05.01 Aqualung	Includes: • compressed air cylinder • scuba equipment
	10.05.05 Diving belt, weight	
	10.05.10 Wetsuit	
	10.05.15 Goggle/mask, flipper/fin, snorkel	
	10.05.98 Other specified diving equipment	
	10.05.99 Unspecified diving equipment	
10.98 Other specified	10.98.01 Personal protective equipment (PPE) designed for	Includes:

Group	Code	Inclusion
equipment for sports/recreational activity	use in sports	• wrist guard, mouth guard, knee pad, helmet • reflective clothing worn in sports activities
	10.98.98 Other specified equipment for sports/recreational activity	
10.99 Unspecified equipment for sports/recreational activity		
11 Tool, machine, apparatus mainly used for *work-related activity*		
11.01 Machinery or fixed plant	11.01.01 Cutting/slicing *machinery* or fixed plant	
	11.01.05 Crushing/pressing *machinery* or fixed plant	
	11.01.10 Heating/cooking *machinery* or fixed plant	
	11.01.15 Refrigeration *machinery* or fixed plant	
	11.01.20 Lifting machinery	
	11.01.25 Hoist machinery	
	11.01.30 Crane *machinery* or fixed plant	
	11.01.35 Elevated work platform	
	11.01.40 Conveyors, etc.	
	11.01.45 Mains – gas, water, sewerage, steam, hot water, electricity	
	11.01.50 Shearing plant	
	11.01.55 Dairy/milking plant	
	11.01.60 Press	Includes: • metal forming press
	11.01.65 Garbage compactor	
	11.01.70 Threshing machine	
	11.01.71 Chaff-cutter, fodder-cutter	
	11.01.98 Other specified *machinery* or fixed plant	
	11.01.99 Unspecified *machinery* or fixed plant	
11.02 Powered hand tool/equipment	11.02.01 Drill	
	11.02.05 Chainsaw	
	11.02.10 Other power saw	Includes: • circular saw, jigsaw
	11.02.15 Welder, welding equipment	
	11.02.20 Nail gun, stud driver	
	11.02.25 Grinder, buffer, polisher, sander	
	11.02.30 Powered garden tool	Includes: • leaf shredder • hedge trimmer
	11.02.35 Powered push lawnmower	
	11.02.40 Industrial vacuum cleaner	
	11.02.98 Other specified powered hand tool/equipment	
	11.02.99 Unspecified powered hand tool/equipment	
11.03 Unpowered hand tool/equipment	11.03.01 Push lawnmower (unpowered)	
	11.03.05 Hammer, mallet	
	11.03.10 Chopping tool	Includes: • axe, hatchet
	11.03.15 Cutting tool	Includes: • chisel • handsaw
	11.03.20 Digging or tilling tool	Includes: • spade, shovel • mattock • garden fork, pitchfork
	11.03.25 Lifting tool	
	11.03.30 Nail, screw, tack	
	11.03.35 Fishhook used for work-related activity	
	11.03.40 Rat/mouse trap used for *work-related activity*	
	11.03.98 Other specified unpowered hand tool/equipment	
	11.03.99 Unspecified unpowered hand tool/equipment	
11.04 Pressure-based equipment	11.04.01 Gas cylinder	
	11.04.05 Pressurised hose, pipe	
	11.04.98 Other specified pressure-based equipment	
	11.04.99 Unspecified pressure-based equipment	
11.05 Other unpowered equipment	11.05.01 Ladder, movable step	
	11.05.05 Scaffolding	
	11.05.10 Helmet	
	11.05.15 Earplugs	
	11.05.20 Welding mask	

Group	Code	Inclusion
	11.05.28 Personal protective equipment (PPE) NEC	Includes: • gloves • protective eyewear • reflective clothing
	11.05.30 Fire extinguisher	
	11.05.98 Other specified unpowered equipment	
	11.05.99 Unspecified unpowered equipment	
11.98 Other specified tool, machine, apparatus, mainly used for work-related activities	11.98.01 Mechanical power transmission device	
	11.98.98 Other specified tool, machine, apparatus	
	11.99 Unspecified tool, machine, apparatus, mainly used for work-related activities	
12 Weapon		
12.01 Sharp object	12.01.01 Spear, javelin designed as weapon	
	12.01.05 Arrow (bow and arrow) or bolt (crossbow) designed as weapon	
	12.01.10 Knife designed as weapon	Includes: • hunting, flick, sheath knife
	12.01.15 Sword, dagger, bayonet, machete, panga, cutlass	
	12.01.98 Other specified sharp object	
	12.01.99 Unspecified sharp object	
12.02 Firearm or related item	12.02.01 Bullet, pellet	Includes: • dum-dum bullet, rubber bullet, etc.
	12.02.05 Hand gun	Includes: • gun for single hand use, pistol, revolver
	12.02.10 Rifle	Includes: • army rifle, hunting rifle, machine gun
	12.02.15 Shotgun	
	12.02.20 Airgun	Includes: • spring-operated gun, BB gun
	12.02.98 Other specified firearm or related item	Includes: • Verey pistol, flare
	12.02.99 Unspecified firearm or related item	
12.98 Other specified weapon	12.98.01 Club, cudgel, rod, knopkierie	
	12.98.05 Electrical prod, stun gun	
	12.98.10 Capsicum spray, mace, pepper spray	
	12.98.98 Other specified weapon	
12.99 Unspecified weapon		
13 Animal, plant, or person		
13.01 Plant	13.01.03 Tree, plant	Includes: • tree root
	13.01.05 Leaves, flowers	
	13.01.13 Mushroom, toadstool, fungus	
	13.01.25 Plant seed	
	13.01.30 Fruit from plant	Includes: • coconut, jack, durian
	13.01.34 Plant thorn	
	13.01.35 Branch or stick (as separate from tree, plant)	
	13.01.50 Venomous or toxic plant NEC	Includes: • injection of poison or toxin into or through skin by plant thorn, spine, nettle, or other object • ingestion of poisonous plant or part of plant • marine plant
	13.01.98 Other specified plant	
	13.01.99 Unspecified plant	
13.02 Bird	13.02.01 Ostrich, emu	
	13.02.05 Parrot, parakeet, cockatoo	
	13.02.10 Raven, crow, magpie	
	13.02.98 Other specified bird	
	13.02.99 Unspecified bird	
13.03 Insect, invertebrate	13.03.01 Bee	
	13.03.05 Wasp	
	13.03.10 Hornet	
	13.03.15 Ant	

Group	Code	Inclusion
	13.03.20 Spider	Includes: • black widow spider, tarantula
	13.03.25 Scorpion	
	13.03.30 Tick	
	13.03.35 Centipede, millipede	
	13.03.98 Other specified insect, invertebrate	Includes: • caterpillar
	13.03.99 Unspecified insect, invertebrate	
13.04 Land mammal	13.04.01 Dog	
	13.04.05 Cat	Includes: • feral (wild) cat
	13.04.10 Rat, guinea pig, mouse	Includes: • wild rat
	13.04.15 Pig, wild boar	
	13.04.20 Sheep, goat	
	13.04.25 Cow, bull, bovine animals	Includes:water buffalo
	13.04.30 Horse, pony, donkey, mule, ass	
	13.04.35 Baboon, monkey, chimpanzee, gorilla	
	13.04.40 Marsupials	Includes: • kangaroo, wallaby
	13.04.45 Deer, moose, antelope, zebra, wildebeest	
	13.04.50 Hippopotamus	
	13.04.55 Lion, puma, panther, cougar, mountain lion, tiger	
	13.04.60 Bear, grizzly bear, polar bear	
	13.04.65 Elephant	
	13.04.70 Buffalo, bison, African buffalo	
	13.04.98 Other specified land mammal	
	13.04.99 Unspecified land mammal	
13.05 Marine animal	13.05.01 Shark	
	13.05.05 Other fishes	
	13.05.10 Sea snake	Includes: • venomous sea snake
	13.05.15 Marine mammal	Includes: • dolphin, whale, sea lion, etc.
	13.05.20 Jellyfish	
	13.05.25 Coral	
	13.05.98 Other specified marine animal	Includes: • anemone, cucumber, urchin
	13.05.99 Unspecified marine animal	
13.06 Reptile or amphibian	13.06.01 Non-venomous snake	
	13.06.05 Venomous snake	
	13.06.10 Snake, unspecified whether venomous or not	Includes: • cases not specified whether or not a sea snake
	13.06.15 Lizard, gecko, goanna	Includes: • venomous lizards
	13.06.20 Frog, toad	Includes: • venomous frog
	13.06.25 Crocodile, alligator	Includes: • saltwater crocodiles
	13.06.98 Other specified reptile or amphibian	
	13.06.99 Unspecified reptile or amphibian	
13.07 Person(s)	13.07.01 Person, self	Includes: • cases where person's own body weight is largely responsible for injury • hitting one’s own head with fist
	13.07.10 Crowd of people	
	13.07.98 Other specified person	
	13.07.99 Unspecified person	
13.98 Other specified animal		
13.99 Unspecified animal		
14 Building, building component, or related fitting		
14.01 Building fitting	14.01.01 Flush toilet	Includes: • part, fixture
	14.01.05 Pit latrine	
	14.01.10 Bathtub	Includes: • part, fixture (eg., tap) • fixed or moveable bath

Group	Code	Inclusion
	14.01.15 Shower	Includes: • part, fixture (eg., tap) • portable shower
	14.01.20 Fitted counter, counter-top, kitchen top	
	14.01.98 Other specified building fitting	
	14.01.99 Unspecified building fitting	
14.02 Door, window, or related fitting/feature	14.02.01 Door, door sill	Includes: • door handle • door with small glass panel
	14.02.05 Glass door	Includes: • door that is mostly glass, storm door
	14.02.10 Security door or gate, fly gate	
	14.02.15 (Burglar) bars on windows	
	14.02.20 Window	Includes: • window pane, window sill, window handle • frosted glass window
	14.02.25 Exterior window shutters	
	14.02.98 Other specified door or window related fitting/feature	
	14.02.99 Unspecified door or window related fitting/feature	
14.03 Floor or related fitting/feature	14.03.01 Floor – carpeted	
	14.03.05 Floor – tile, brick, concrete	
	14.03.10 Floor – wood	
	14.03.15 Floor – mud, clay, animal dung	
	14.03.98 Other specified floor or relating fitting/feature	
	14.03.99 Unspecified floor or related fitting/feature	
14.04 Wall or related fitting/feature	14.04.01 Fireplace	
	14.04.05 Built-in barbeque	
	14.04.10 Wall – brick, concrete, tile	
	14.04.15 Wall – wood	
	14.04.20 Wall – mud, clay, animal dung	
	14.04.98 Other specified wall or related fitting/feature	
	14.04.99 Unspecified wall or related fitting/feature	
14.98 Other specified building, building component, or fitting	14.98.01 In-ground swimming pool	Includes: • in-ground spa
	14.98.02 Above-ground swimming pool, external spa, or hot tub	Includes: • inflatable swimming pool for children • above-ground spa outside home
	14.98.05 Fence, gate	
	14.98.10 Moving ramp, escalator	
	14.98.15 Lift, elevator	
	14.98.16 Stairs, steps	Includes: • stair or step covered with ice • steps anywhere (eg., leading to beach)
	14.98.20 Handrail, railing, banister	
	14.98.50 Electrical transmission line in or around building	
	14.98.55 Fittings/pipes for gas, steam, hot water	
	14.98.60 Electrical fixture	Includes: • outlets, sockets, switches
	14.98.61 Ducted air-conditioning unit or related fitting	
	14.98.98 Other specified building, building component, or fitting	Includes: • building feature NEC • part of building (eg., balcony, roof)
14.99 Unspecified building, building component, or fitting		
15 Ground surface or surface conformation		
15.01 Ground surface	15.01.01 Cliff	
	15.01.05 Slope, ramp	
	15.01.10 Trench, ditch, pit	
	15.01.15 Sewer grate	Includes: drain grate
	15.01.20 Open drain, channel	Includes: • storm water drain, monsoon drain
	15.01.98 Other specified ground surface	
	15.01.99 Unspecified ground surface	

Group	Code	Inclusion
15.02 Body of water	15.02.01 Man-made well, dug well for underground water	
	15.02.05 Water reservoir	
	15.02.15 Puddle	
	15.02.20 Dam, lake	
	15.02.25 River, stream	
	15.02.30 Swamp, marsh	
	15.02.35 Beach, seashore	Includes: • rocky seashore
	15.02.40 Open sea	
	15.02.98 Other specified body of water	
	15.02.99 Unspecified body of water	
15.98 Other specified surface conformation	15.98.08 Sloping surface NEC	
	15.98.18 Even surface NEC	
	15.98.28 Uneven surface NEC	
	15.98.98 Other specified surface conformation	
15.99 Unspecified surface conformation		
16 Material NEC		
16.01 Natural material	16.01.01 Snow, ice	
	16.01.05 Natural grass	
	16.01.08 Rock, stone NEC	
	16.01.10 Wood – timber, board, splinter NEC	
	16.01.15 Gravel, soil, sand NEC	
	16.01.19 Hay, straw	Includes: • bale(s) of hay
	16.01.20 Grain in bulk	Includes: • grain in silo
	16.01.98 Other specified natural material	
	16.01.99 Unspecified natural material	
16.02 Manufactured/industrial material	16.02.01 Artificial grass	
	16.02.05 Bitumen, asphalt	
	16.02.08 Brick, concrete, concrete block	
	16.02.10 Molten metal	
	16.02.18 Metal – sheet, part, piece etc.	
	16.02.28 China, ceramics – sheet, part, piece etc.	
	16.02.30 Molten glass	
	16.02.38 Glass – sheet, piece, shard, etc.	
	16.02.40 Frozen liquid or gas (with temperature < 0°C/ 32°F)	
	16.02.58 Plastic	
	16.02.68 Paper, cardboard, etc.	Includes: • rolls of paper
	16.02.98 Other specified manufactured/industrial material	
	16.02.99 Unspecified manufactured/industrial material	
16.98 Other specified material, NEC		
16.99 Unspecified material, NEC		
17 Fire, flame, smoke		
17.01 Fire, flame	17.01.01 Burning oil	
	17.01.05 Other burning liquid	
	17.01.10 Burning gas NEC	
	17.01.15 Controlled fire, flame in building or structure	Includes: • fire in fireplace
	17.01.20 Controlled fire, flame, not in building or structure	Includes: • campfire • open fire for cooking
	17.01.25 Uncontrolled fire, flame in building or structure	Includes: • burning building • burning fittings, furniture, etc.
	17.01.30 Uncontrolled fire, flame not in building or structure	Includes: • forest fire
	17.01.98 Other specified fire or flame	
	17.01.99 Unspecified fire or flame	
17.02 Smoke		
17.99 Unspecified as to whether fire, flame, or smoke caused the injury		Includes: • cases where it is obvious that fire or flame caused the injury (eg. burns), however, the actual cause is not specified.
18 Hot object/substance NEC		

Group	Code	Inclusion
18.01 Hot liquid	18.01.01 Hot tap water	Includes: • hot water in bath, bucket, or tub • hot water from hose or showerhead
	18.01.05 Boiling water (other than tap water)	Includes: • water heated on stove
	18.01.98 Other specified hot liquid	
	18.01.99 Unspecified hot liquid	
18.02 Hot air or gas	18.02.01 Steam, hot vapour	
	18.02.98 Other specified hot air or gas	
	18.02.99 Unspecified hot air or gas	
18.98 Other specified hot object/substance		
18.99 Unspecified hot object/substance		
19 Food, drink		
19.01 Food, drink, or related product	19.01.01 Stroopwafels	
	19.01.05 Hot cooking oil or fat	
	19.01.10 Hot solid food	
	19.01.15 Hot drink	Includes: • coffee, tea
	19.01.20 Cold solid food	
	19.01.25 Cold drink – non-alcoholic	
	19.01.30 Drink – alcoholic	Includes: • beer, wine, whisky, brandy, vodka, sherry, etc.
19.98 Other specified food, drink		Includes: • processed pet food or animal feed
19.99 Unspecified food, drink		
20 Pharmaceutical substance for human use, ie. drug, medicine		
20.01 Analgesic, antipyretic, antirheumatic	20.01.01 Paracetamol only preparation	
	20.01.05 Aspirin only preparation	
	20.01.10 Paracetamol in combination with aspirin only	
	20.01.15 Paracetamol in combination with codeine and/or other substances	
	20.01.20 Aspirin in combination with codeine and/or other substances	
	20.01.25 Codeine only preparation	
	20.01.30 Morphine	
	20.01.35 Methadone	
	20.01.40 Oxycodone	
	20.01.45 Ibuprofen	
	20.01.50 Indomethacin	
	20.01.58 Other nonsteroidal anti-inflammatory drug (NSAID)	
	20.01.98 Other specified analgesic, antipyretic or antirheumatic	
	20.01.99 Unspecified analgesic, antipyretic or antirheumatic	
20.02 Antimicrobial, anti-infective agent	20.02.01 Antibacterial agent containing penicillin	
	20.02.02 Antibacterial agent containing tetracycline	
	20.02.03 Antibacterial agent containing cefalosporins and other beta-lactam	
	antibiotics	
	20.02.04 Antibacterial agent containing substance from chloramphenical	
	group	
	20.02.05 Antibacterial agent containing macrolides	
	20.02.06 Antibacterial agent containing aminoglycosides	
	20.02.07 Antibacterial agent containing rifamycins	
	20.02.18 Other antibacterial agent	
	20.02.19 Unspecified antibacterial agent	
	20.02.20 Antifungal antibiotic	
	20.02.25 Sulfonamides	
	20.02.30 Antimycobacterial drugs	
	20.02.35 Antituberculotic, antileprotic	
	20.02.40 Antimalarial drug	
	20.02.48 Other antiprotozoal agent	
	20.02.50 Antiviral agent	
	20.02.55 Anthelmintic agent	

Group	Code	Inclusion
	20.02.60 Ectoparasiticide preparation	Includes: • scabicide
	20.02.98 Other specified antimicrobial, anti-infective agent	
	20.02.99 Unspecified antimicrobial, anti-infective agent	
20.03 Cold and cough preparation		
20.04 Asthma therapy	20.04.01 Aminophylline/theophylline	
	20.04.05 Terbutaline and other beta-2 antagonist	
	20.04.10 Other beta antagonist	
	20.04.98 Other specified asthma therapy	
	20.04.99 Unspecified asthma therapy	
20.05 Antihistamine	20.05.01 Diphenhydramine	
	20.05.98 Other specified antihistamine	
	20.05.99 Unspecified antihistamine	
20.06 Antidepressant	20.06.01 Amitriptyline	
	20.06.05 Desipramine	
	20.06.10 Doxepin	
	20.06.18 Other cyclic antidepressant	
	20.06.20 Lithium	
	20.06.30 Monoamine oxydase (MAO) inhibitors	
	20.06.40 Selective seratonin receptor inhibitor (SSRI)	
	20.06.98 Other specified antidepressant	
	20.06.99 Unspecified antidepressant	
20.07 Sedative, hypnotic, antipsychotic	20.07.01 Barbiturate	
	20.07.05 Benzodiazepine	
	20.07.10 Chloral hydrate	
	20.07.15 Phenothiazine	
	20.07.98 Other specified sedative, hypnotic, antipsychotic	
	20.07.99 Unspecified sedative, hypnotic, antipsychotic	
20.08 Anticonvulsant	20.08.05 Carbamazepine	
	20.08.10 Phenytoin	
	20.08.15 Succinimides	
	20.08.20 Valproic acid	
	20.08.98 Other specified anticonvulsant	
	20.08.99 Unspecified anticonvulsant	
20.09 Cardiovascular drug	20.09.01 ACE inhibitor	
	20.09.05 Alpha blocker	
	20.09.10 Antiarrhythmics	
	20.09.15 Antihypertensive	
	20.09.20 Beta blocker	
	20.09.25 Nitroglycerin	
	20.09.98 Other specified cardiovascular drug	
	20.09.99 Unspecified cardiovascular drug	
20.10 Diuretic	20.10.01 Furosemide	
	20.10.05 Thiazide	
	20.10.98 Other specified diuretic	
	20.10.99 Unspecified diuretic	
20.11 Anticoagulant	20.11.05 Heparin	
	20.11.10 Warfarin	
	20.11.98 Other specified anticoagulant	
	20.11.99 Unspecified anticoagulant	
20.12 Gastrointestinal preparation	20.12.01 Antacid, antiflatulent, drug for treatment of peptic ulcer	Includes: • Aluminium hydroxide, calcium carbonate, magnesium carbonate, magnesium trisilicate, sodium bicarbonate
	20.12.05 Antispasmodic, anticholinergic, propulsive	
	20.12.10 Anti-emetic, anti-nauseant preparation	
	20.12.15 Laxative	
	20.12.20 Antidiarrhoeal, intestinal anti-inflammatory, intestinal anti-infective agent	Includes: • Loperamide, kaolin
	20.12.25 Stomatological preparation, mouth preparation	
	20.12.98 Other specified gastrointestinal preparation	
	20.12.99 Unspecified gastrointestinal preparation	
20.13 Diagnostic agent	20.13.01 Radiographic agent	
	20.13.05 Agent for urinalysis	
	20.13.98 Other specified diagnostic agent	
	20.13.99 Unspecified diagnostic agent	
20.14 Anti-neoplastic agent	20.14.01 Cytostatic preparation	
	20.14.05 Preparations for endocrine therapy	

Group	Code	Inclusion
	20.14.10 Immunomodulating preparation	
	20.14.98 Other specified anti-neoplastic agent	
	20.14.99 Unspecified anti-neoplastic agent	
20.15 Anaesthetic	20.15.01 Nitrous oxide	
	20.15.08 Other inhalation anaesthetic	
	20.15.10 Ketamine	
	20.15.15 Intravenous anaesthetic	
	20.15.20 Local and topical anaesthetic	
	20.15.30 Therapeutic gases	Includes: • Oxygen
	20.15.98 Other specified anaesthetic	
	20.15.99 Unspecified anaesthetic	
20.16 Muscle relaxant		
20.17 Narcotic antagonist		
20.18 Eye/ear/nose/throat preparation	20.18.01 Nasal preparation	Includes: • topical antibiotic
	20.18.10 Ophthalmic preparation	Includes: • glaucoma therapies • topical antibiotic
	20.18.20 Otic preparation	Includes: • topical antibiotic
	20.18.30 Topical steroid for eye/ear/nose/throat	Includes: • mouth, gums and tongue
	20.18.40 Lozenges with or without local anaesthetic for throat	
	20.18.98 Other specified throat preparation	Includes: • mouth, gums and tongue • topical antibiotic
	20.18.99 Unspecified throat preparation	Includes mouth, gums and tongue
20.19 Topical preparation	20.19.01 Acne preparation	
	20.19.05 Boric acid, borate	
	20.19.10 Calamine lotion	
	20.19.15 Camphor/methyl salicylate	
	20.19.20 Iodine or iodide antiseptic	
	20.19.28 Other topical antiseptic	
	20.19.30 Podophyllin	
	20.19.35 Silver nitrate	
	20.19.40 Topical steroid	
	20.19.45 Topical steroid with antibiotic	
	20.19.50 Wart preparation	
	20.19.98 Other specified topical preparation	
	20.19.99 Unspecified topical preparation	
20.20 Vitamin or dietary supplement	20.20.01 (Multi-)vitamin with iron	
	20.20.05 (Multi-)vitamin without iron	
	20.20.98 Other specified vitamin or dietary supplement	
	20.20.99 Unspecified vitamin or dietary supplement	
20.21 Electrolyte or mineral	20.21.10 Calcium	
	20.21.15 Fluoride	
	20.21.20 Iron	Includes: • iron preparation provided to pregnant women
	20.21.25 Potassium	
	20.21.30 Sodium	
	20.21.98 Other specified electrolyte or mineral	
	20.21.99 Unspecified electrolyte or mineral	
20.22 Serum, toxoid, vaccine	20.22.01 Diphtheria	
	20.22.05 Measles	
	20.22.10 Mumps	
	20.22.15 Rubella	
	20.22.20 Polio	
	20.22.25 Pertussis	
	20.22.30 Tetanus	
	20.22.35 Cholera	
	20.22.40 Typhoid	
	20.22.45 Yellow fever	
	20.22.50 Hepatitis (A or B)	
	20.22.55 Influenza	
	20.22.60 Combination vaccine	
	20.22.65 Anti-snake bite serum	
	20.22.98 Other specified serum, toxoid, vaccine	

Group	Code	Inclusion
	20.22.99 Unspecified serum, toxoid, vaccine	
20.23 Hormone, hormone antagonist, contraceptive	20.23.01 Oral or injectable contraceptive	
	20.23.02 Other oestrogen, progesterone or progestogen preparation	
	20.23.03 Antigonadatrophin, anti-oestrogen, antiandrogen preparation	
	20.23.05 Spermicidal contraceptive	
	20.23.08 Other specified preparation containing sex hormones	
	20.23.15 Insulin or oral hypoglycaemic (antidiabetic) drug	
	20.23.20 Corticosteroids	
	20.23.25 Thyroid hormone or substitute	
	20.23.26 Antithyroid drugs	
	20.23.98 Other specified hormone, hormone antagonist, contraceptive	
	20.23.99 Unspecified hormone, hormone antagonist, contraceptive	
20.24 “Street”/recreational drug	20.24.01 Amphetamine	
	20.24.05 Cocaine, crack	
	20.24.10 Ecstasy	
	20.24.15 Heroin	
	20.24.20 LSD	
	20.24.25 Marijuana, hashish, dagga, ganja	
	20.24.98 Other specified “street”/recreational drug	
	20.24.99 Unspecified “street”/recreational drug	
20.98 Other specified pharmaceutical substance for human use	20.98.01 Allopurinol	
	20.98.05 L-dopa or related drug	
	20.98.10 Diet aid	
	20.98.18 Other general nutrient, dietary supplement	
	20.98.20 Detoxifying agent, antidote	
	20.98.25 Disulfram	
	20.98.30 Ergot alkaloid	
	20.98.35 Nicotine pharmaceutical	
	20.98.98 Other specified pharmaceutical substance for human use	
20.99 Unspecified pharmaceutical substance for human use		
21 Other non-pharmaceutical chemical substance		
21.01 Glue or adhesive	21.01.01 Contact glue	
	21.01.05 Epoxies	
	21.01.10 Cyanoacrylate glue (Super glue□)	
	21.01.98 Other specified glue or adhesive	
	21.01.99 Unspecified glue or adhesive	
21.02 Fuel or solvent	21.02.01 LPG gas, natural gas, methane gas, propane gas, butane gas	
	21.02.05 Petrol, diesel, gasoline	
	21.02.10 Lubricating oils, motor oil	
	21.02.15 Methylated spirits	
	21.02.20 Kerosene/paraffin	
	21.02.25 Turpentine	
	21.02.38 Alcohol NEC	Includes: • butyl alcohol, isopropyl alcohol, propyl alcohol, methanol, ethanol
	21.02.98 Other specified fuel or solvent	
	21.02.99 Unspecified fuel or solvent	
21.03 Paint, coating or stripping agent	21.03.01 Paint, varnish, stain	
	21.03.05 Paint thinner, paint stripper	
	21.03.10 Rust remover	
	21.03.98 Other specified coating or stripping agent	
	21.03.99 Unspecified coating or stripping agent	
21.04 Pet (veterinary) product, pesticide, herbicide	21.04.01 Pet (veterinary) product	Includes: • dog or cat shampoo • flea dip, flea powder
	21.04.05 Mouse, rat poison	
	21.04.06 Moth repellent	Includes: • naphthalene
	21.04.10 Organophosphate NEC	
	21.04.15 Synthetic pyrethroids	
	21.04.18 Other insecticide	Includes:

Group	Code	Inclusion
		• surface spray, spray for flying insect, etc.
	21.04.25 Fungicide	
	21.04.30 Weed killer, herbicide	
	21.04.98 Other specified pesticide, herbicide	
	21.04.99 Unspecified pesticide, herbicide	
21.05 Cleaning agent	21.05.01 Detergent for dishes or dishwasher, rinse aid	
	21.05.05 Laundry detergent or additive, fabric softener, stain remover	
	21.05.10 Dry cleaning agent NEC	
	21.05.15 Bleach, soaking agent	
	21.05.20 Chlorine	
	21.05.25 Lye soap	
	21.05.30 Disinfectants	
	21.05.35 Drain cleaners	
	21.05.98 Other specified cleaning agent	
	21.05.99 Unspecified cleaning agent	
21.06 Reactant used in chemical industry process, industry manufacturing NEC		Includes: • battery acid
21.98 Other specified non-pharmaceutical chemical substance	21.98.01 Motor vehicle exhaust gas	
	21.98.03 Other sources of carbon monoxide	
	21.98.05 Carbon dioxide NEC	
	21.98.15 Mercury	
	21.98.20 Lead	
	21.98.28 Heavy metal NEC	Includes: • barium, cadmium, copper, selenium, thallium • arsenic
	21.98.30 Plant food or fertiliser, plant hormones	
	21.98.40 Fabric dye	
	21.98.50 Leather dye	
	21.98.60 Food dye	
	21.98.70 Photographic products	Includes: • developers/fixing/stop baths • photographic coating fluids
	21.98.80 Traditional medicine, folk remedy NEC	
	21.98.98 Other specified non-pharmaceutical chemical substance	
21.99 Unspecified non-pharmaceutical chemical substance		
40 Medical/surgical device		
40.01 General hospital or personal use device	40.01.01 Hypodermic needle/syringe	
	40.01.05 Glass thermometer with mercury	
	40.01.08 Other type of thermometer	
	40.01.10 Device, hoist for lifting patients	
	40.01.98 Other specified general hospital or personal use device	
	40.01.99 Unspecified general hospital or personal use device	
40.02 General or plastic surgery device		
40.03 Anaesthesiology device		
40.04 Cardiovascular device		
40.05 Ear/nose/throat device		
40.06 Gastroenterology device		
40.07 Neurological device		
40.08 Obstetric or gynaecological device		
40.09 Ophthalmic device		
40.10 Orthopaedic device		
40.11 Radiological		

Group	Code	Inclusion
device		
40.12 Physical medicine device		
40.98 Other specified medical/surgical device		
40.99 Unspecified medical/surgical device		
98 Other specified object/substance		
98.01 Law enforcement equipment	98.01.01 Handcuffs	
	98.01.98 Other specified law enforcement equipment	Includes • "anti-protest" gear
	98.01.99 Unspecified law enforcement equipment	
98.02 Public use item	98.02.01 Fire hydrant	
	98.02.05 Telephone pole, Stobie pole	Includes: • pole holding telephone lines, power lines, or street lights
	98.02.10 High-tension overhead power line	
	98.02.98 Other specified public use item	Includes: • pedal cycle rack • bus shelter • utility box
	98.02.99 Unspecified public use item	
98.03 Camping equipment	98.03.01 Tent	
	98.03.98 Other specified camping equipment	Includes: • camping/propane stove • propane lamp
	98.03.99 Unspecified camping equipment	
98.04 Fastening, binding, or securing item NEC	98.04.01 Rope, string, or twine	
	98.04.05 Barbed wire	Includes: razor wire
	98.04.08 Other wire	
	98.04.10 Chain	
	98.04.98 Other specified fastening, binding, or securing item	
	98.04.99 Unspecified fastening, binding, or securing item	
98.05 Explosive material or flammable object/substance NEC	98.05.01 Fireworks	Includes: sparklers
	98.05.05 Explosive	Includes: • dynamite, blasting caps, homemade bombs • incendiary device
	98.05.98 Other specified explosive material or flammable object/substance	Includes: • explosive material in dump, factory, grain store, munitions • explosive gas
	98.05.99 Unspecified explosive material or flammable object/substance	
98.98 Other specified object/substance	98.98.01 High-pressure jet	Includes: • water from a fire hydrant/hose • fluid from a pressure-washer
	98.98.05 Laser light and equipment	
	98.98.10 Laser pointer	
	98.98.28 Sharp object NEC	
	98.98.38 Blunt object NEC	
	98.98.48 Motor, engine NEC	
	98.98.50 Dry cell battery	
	98.98.55 Disc battery	Includes: • alkaline, lithium, nickel cadmium battery, watch battery
	98.98.58 Battery NEC	
	98.98.60 Animal cage	
	98.98.70 Gastric content	Includes: • vomitus
	98.98.75 Excrement (human/animal)	
	98.98.78 Blood, carcass, body, bone NEC (human/animal)	
	98.98.80 Plastic bag	
	98.98.85 Garbage, litter, trash	
	98.98.88 Environmental pollution NEC	
	98.98.98 Other specified object/substance	
99 Unspecified object/substance		

Appendix 6: Reactive Identification of Product-related Injuries

Background

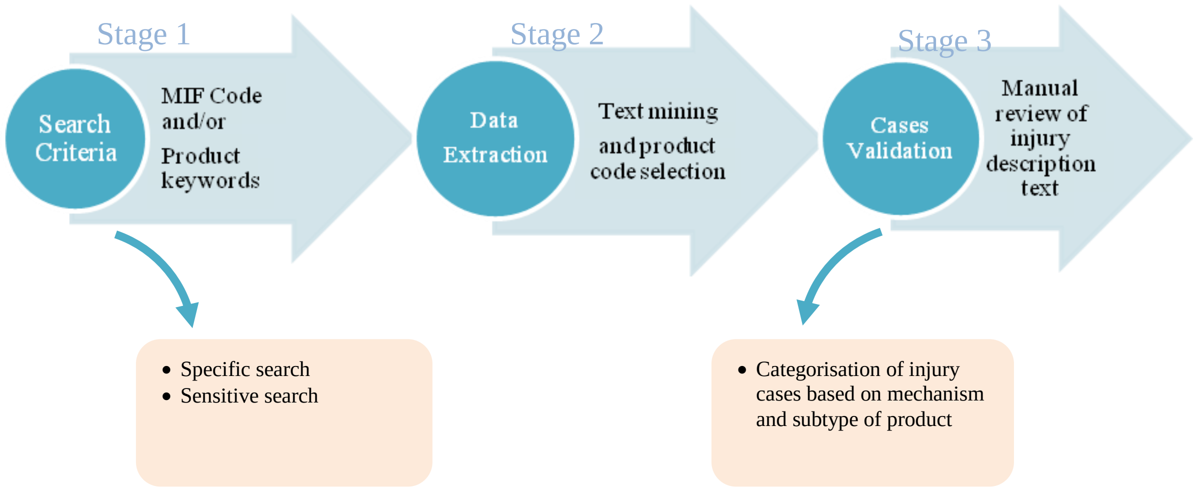
A ***reactive approach*** is defined as a process of identifying injuries that are related to a specific known type of product (i.e. those which product safety regulators are aware of and are seeking data for). There were three techniques used in the study including: code analysis for the proactive approach, text mining and combined techniques for the reactive approach. The three techniques were utilised in interrogating the emergency department presentations recorded in the Queensland Injury Surveillance Unit (QISU). A reactive approach was deemed inappropriate for the QHAPDC data as the products of concern in the reactive phase had no relevant codes captured in the QHAPDC data, hence no cases would have been able to be identified.

Methods

Reactive searching of product-related injuries to identify specific types of products of concern was conducted using search algorithms for text narratives and/or coded data. In order to perform reactive searching for specific types of products in QISU data, MIF codes were used as the first search point. However, due to the limitations in the coded data as explained in the literature review, this study involved a keyword search in the injury description narratives in conjunction with a code search (Stage 1). This was performed with an "OR" function in the search query to ensure that all variations of related injury cases were captured (Stage 2). For products that were not specifically coded by MIF classification, only text searches were performed.

In order to improve the diagnostic power of the search algorithms, techniques to maintain a balance between specificity and sensitivity in text searching involved a selection of keywords to indicate products, which also incorporated a range of common misspellings and grammatical variants. A keywords dictionary was obtained from QISU to ensure that the most common variation in product names and misspellings were incorporated in the search. Depending on the type of product of concern, the combination of keywords and codes in the search criteria produced a specific search or a sensitive search depending on the specificity and sensitivity of codes and keywords used in the search. *Specificity* is defined as the ability of the search algorithm to exclude unrelated cases (to avoid false positive) where as *sensitivity* is defined as the ability of the search to identify related cases (true positive) (McKenzie, Campbell, et al., 2010; Williamson, et al., 2001).

After data were extracted from the larger dataset for reactive identification of product-related injuries, related cases were validated through manual review of injury description text conducted by the PhD candidate (Stage 3). At this stage, injury cases were categorised based on mechanism and the subtype of product if applicable.



Several products were selected as examples of reactive identification of product-related injuries in QISU data. These products were selected because they were regulated under permanent ban or mandatory standard or were a concern to the product safety regulator. Below are the selected products and the search criteria used in the reactive approach:

Table 8-3 Search criteria for reactive identification of product-related injuries

Product	Keywords	Codes	Notes
Aquatic toys	Toy, buoyancy, float, flot, noodle, ring, doughnut, donut, inflatabl	N/A	
Bean bags	Bean, styrene, styro, styrofoam	N/A	
Bunk beds	Bunk	0202 Bunk bed	
Projectile toys	Project, gun, dart , bow , arrow, rocket, sling, shot	N/A	
Occy straps	Occy, ocky, strap, octopus, luggage, elastic, bungee cord, bungy cord, bungie cord, shock cord	N/A	Exclude 'coccy'
Magnetic toys	Magn		
High chairs	Booster, high chair, highchair, highc, bumbo, bebe pod, bebepod	0103 High chair	
Battery	Battery, batteries, lithium, lithim	N/A	
Sparklers	Propellant, ammunition, sparkler, party popper, detonator, firework, detonator, explo, bomb, blast, ignit, implo, missile, gunpowder, blew up	N/A	
Oven doors	Oven	N/A	

Results

Utilising the search criteria outlined above, QISU paediatric data from 2008 – 2010 were searched for household chemicals, bean bag beans, projectile toys, occy straps, magnetic toys, high chairs, button batteries, sparklers and oven door injuries. Depending on the specificity and sensitivity of the search criteria and the type of product, some searches identified large numbers of cases and some identified fewer.

Bean bags beans

Keywords referring to bean bags were searched in QISU injury description text data extracting 267 cases. After manually reviewing these cases, only 25 bean bag bean-related injuries were identified. This is due to the sensitivity of the search criteria that captured unrelated cases such as injuries related to the food bean, jelly bean or baked bean tin. Two year old toddlers were the group with the highest number of bean bag bean-related injuries (9 cases).

A new category was made for subtype of injury mechanism extracted from manually reviewing the text descriptions. The 25 cases were categorised into three specific mechanisms: ingestion, inhalation and insertion of bean bag beans. Almost all related cases were due to insertion of beans into ears or nostrils (23 cases). The two remaining cases were related to ingestion and inhalation.

Projectile toys

Projectile toys were searched in QISU data keywords and 712 cases were extracted. Validation through manual review identified only 32 related cases. Exclusions were made for those injury cases picked up by the term 'shot' which identified a number of injuries involving shot drinks and vaccination shot. Exclusions were also made for unrelated injuries involving slings as a form of medical treatment for shoulder or arm injuries (picked up by the term 'sling') and for bicycle injuries where sprocket of the bicycle was mentioned in the text (picked up by the term 'rocket').

Within the 32 related cases, projectile toys caused 18 eye injuries, 8 superficial injuries, 3 open wounds, 2 burns and an ear injury. Specific types of projectile toys were also identified from the injury description text. Toy guns (15 cases) were the most prominent type, followed by slingshots (8 cases), arrow & bow toys (6 cases) and darts (3 cases).

Octopus straps

Data extraction using keywords for octopus strap-related injuries found 196 cases. Only 8 cases were validated due to a large amount of cases involving patients being strapped as part of the ED treatment and being picked up by the term 'strap'. All related cases were related to eye injuries.

Magnets

Magnetic toy search using keyword search on QISU data extracted 64 cases in which 55 cases were validated in the manual review. Injury cases involving magnesium tablets and magnum ice creams were excluded. Magnet injuries were commonly found amongst children under the age of 5 years old (26 cases).

A new category was made for the type of magnet. Most magnet injuries were caused by magnetic toys (23 cases). Other types of magnet causing injuries included fridge magnets (3 cases), magnet jewelleries (2 cases) and a magnet from mobile phone case (1 case). The subtype of injury mechanisms extracted from the manual review found that 40 injuries involved ingestion of magnets and 13 cases involved insertion of magnets to body orifices. The two remaining cases were related to choking by a magnet.

High chairs& Booster chairs

The search criteria for high chair and booster chair for dining use incorporated keywords and MIF code for high chair. The search extracted 220 cases from the 2008 – 2010 QISU database in which 154 were validated. Injuries involving booster seats for vehicle use were excluded in the manual review. Only six cases were specifically identified as booster seats for dining. The remaining 142 cases were related to the common type of high chair.

A new variable was created to categorise relevant injuries based on specific mechanisms. More than half of the relevant injuries (65%, 143 cases) were caused by falls from high chairs or booster seats. Seven injuries were caused by children striking against high chairs. One case involved a child being crushed under a falling high chair. The mechanisms of the remaining 3 high chair injuries were not specified.

Button Battery

Search criteria identified 138 cases relating to keywords for battery related injuries. Forty seven button battery injuries were validated. Exclusions were made to injuries caused by exposure to battery acid and/or vehicle batteries. Button battery related injuries were most prominent amongst 2 years old toddlers (12 cases). From the manual review, additional categories were created including: source of battery, mechanism of injury and body region where battery was located. Within the 47 related cases, 37 cases were results of button battery ingestions and the remaining 10 cases were results of button battery insertions to body orifices. A battery was found in the alimentary tract (unspecified part) in 19 cases, in the stomach in 12 cases and in the nose in 9 cases. There were a range of battery sources identified in the manual review, these included watches (13 cases), hearing aids (6 cases), toys (2 cases), laser light (1 case), remote control (1 case) and clock (1 case).

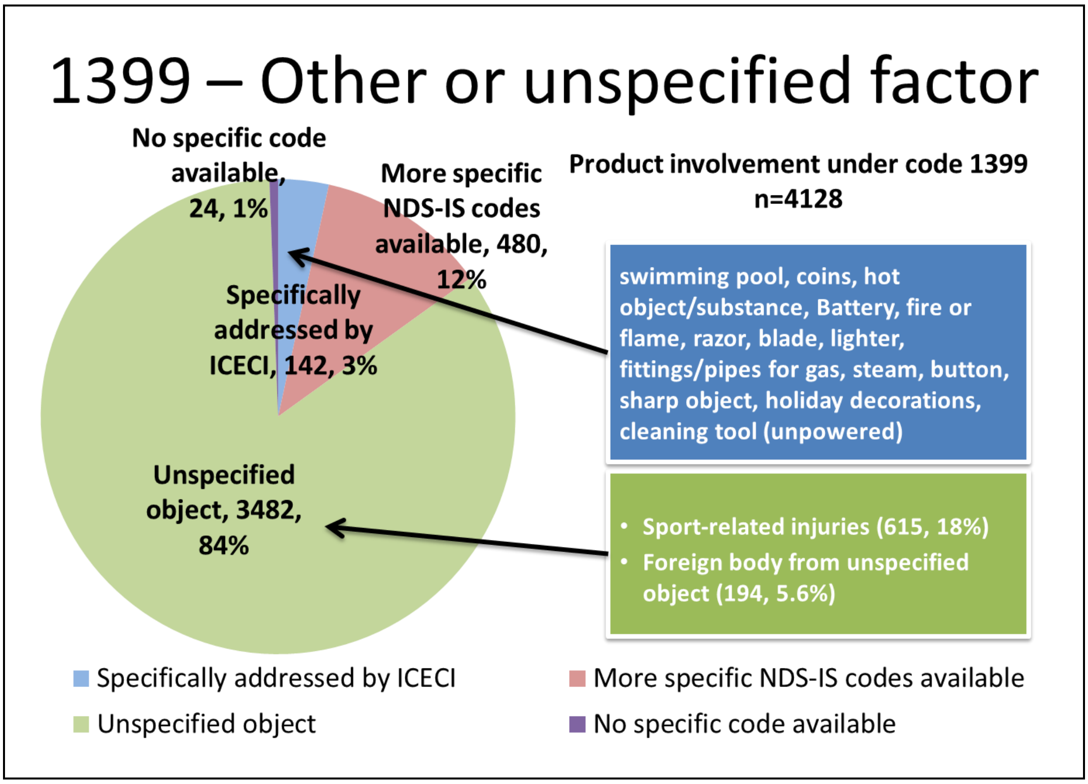
Sparklers

Burns due to sparklers were searched in QISU data using keywords which extracted 28 related cases. Validation through manual review identified only 19 related cases. Within these cases, burns were caused by sparklers in 12 cases, by fireworks in 4 cases and a homemade explosive device in 3 cases.

Oven doors

Data extraction using keywords for oven doors related burns found 84 cases. Forty three related cases were validated in the manual review and exclusions were made to burn injuries caused by hot food from an oven and to injuries from contact with oven cleaners. Oven door burns were most prominent amongst infants under the age of 2 years old (37 cases). Almost all related injuries (34 cases) were caused by burns on hand and wrist resulting from children touching the hot surface of the oven doors.

Appendix 7: Manual review of Other or unspecified factor code



Under the code 1399 for Other and unspecified factor, there were more variation of objects and products. Approximately 13% of injury cases under these codes were related to product (Specifically addressed by ICECI 3% + Miscoded 12%) and 5.6% were related to foreign body injuries which could also be product-related. Approximately 84% of cases didn’t mention the object involved in the injury. The rest of the cases mentioned specific type of product and 12% can be coded with other more specific code in NDS-IS, and only 3% can be coded more specifically using ICECI codes 1% cases where specific product were mentioned but no code is available under ICECI nor NDS-IS. Under the unspecified object group where object is not mentioned in the text, 18% case were sport-related injuries (e.g. Child playing football, running and twist his ankle). Also, approx. 6% mentioned foreign body from an unknown object/product in the triage text.

Appendix 8: ICD-10-AM and RAPEX mapping

Burn

In order to map ICD burn codes to RAPEX severity rates, ICD codes were classified based on burn thickness and body surface area (BSA). RAPEX system focuses on burn thickness and % of body surface, whereas ICD burn codes are structured based on body region. However, burn thickness and body surface are also used as subgroups within each body region.

When coding burn cases using ICD, a principal codes from T20 – T30 range is used to classify the body region and burn thickness indicated in the third character (i.e. erythema, partial thickness and full thickness). Principal code is accompanied by a code from T31 group to indicate the BSA of burn.

RAPEX Injury Severity	RAPEX Laceration	ICD codes
1	First degree, up to 100 % of body surface, Second degree, < 6 % of body surface	T22.1, T22.2, T23.1, T23.2, T24.1, T24.2, T25.1, T25.2, T29.1, T29.2, T30.1, T30.2
2	Second degree, 6-15 % of body surface	T22.2, T23.2, T24.2, T25.2, T29.2, T30.2
3	Second degree, 16-35 % of body surface, or 3o, up to 35 % of body surface, Inhalation burn	T22.2, T22.3, T31.2, T31.3, T23.2, T23.3, T24.2, T24.3, T25.2, T25.3, T29.2, T29.3, T31. T27 (w/o 13882-00 - 13882-02)
4	Second degree or Third degree, > 35 % of body surface, Inhalation burn requiring respiratory assistance	T22.2, T22.3, T31.2, T31.3, T23.2, T23.3, T24.2, T24.3, T25.2, T25.3, T29.2, T29.3, T31. T27 (with 13882-00 - 13882-02)
Unclassifiable	Unspecified thickness burns	T22.0, T23.0, T24.0, T25.0, T26 (.0-.3)

Burn thickness (displayed in third character): Txx.1 – Erythema, Txx.2 – Partial thickness, Txx.3 – Full thickness
BSA (displayed in third character of T31 group: T31.0 <10%, T31.1 10-19%, T31.2 20-29%, T31.3 20 – 39%, T31.4-9 40% and more

Laceration (Open wound)

The severity of laceration is classified under RAPEX rating based on the depth of the wound (for level 1 and 2) and based on body region for level 3 and 4. ICD open wound codes on the other hand, are structured only based on body region only.

Therefore when RAPEX ratings were applied to ICD coded injury data, RAPEX 1 and 2 were unable to be differentiated.

RAPEX Injury Severity	**RAPEX Laceration**	**ICD codes**
1	Superficial	S01, S05 (.2-.7), S08.0, S09.2, S21, S31, T09.1, S41, S51, S61, T01.2, T11.1, S71, S81, S91, T01.3, T13.1, T01.9, T14.1
2	External (deep) (>10cm long on body) (<5cm long on face) tendon or, or into joint white of eye or cornea	S01, S05 (.2-.7), S08.0, S09.2, S21, S31, T09.1, S41, S51, S61, T01.2, T11.1, S71, S81, S91, T01.3, T13.1, T01.9, T14.1
3	Optic nerve, neck artery, trachea, internal organs	S11, S27.32, S27.38, S27 (.4-.7)
4	Bronchial tube, oesophagus, aorta, spinal cord (low) deep laceration of internal organs, severed high spinal cord, brain (severe lesion/dysfunction)	S24, S25, S26.82, S26.83

Superficial

RAPEX differentiates superficial injuries based on the area of the bruising or swelling under level 1 and 2 and superficial injuries of internal organs are rated under level 3 or 4. Similar to ICD open wound codes, ICD superficial injury codes are structured only based on body region. Therefore, when RAPEX ratings were applied to ICD coded injury data, RAPEX 1 and 2 were unable to be differentiated.

RAPEX Injury Severity	**RAPEX Superficial Bruising (Abrasion/Contusion) + swelling, oedema**	**ICD codes**
1	Superficial ≤ 25 cm² on face ≤50 cm² on body	S00, S05 (.0-.1), S10 (.1-9), S20, S30, T09.0, S40, S50, S60, T00, T11.0, S70, S80, S90, T13.0, T14.1
2	Major > 25 cm² on face > 50 cm² on body	S00, S05 (.0-.1), S10 (.1-9), S20, S30, T09.0, S40, S50, S60, T00, T11.0, S70, S80, S90, T13.0, T14.0
3	Trachea, internal organs (minor), heart, brain, lung (with blood or air chest)	S10.1, S26.81, S27.31
4	Brain stem, spinal cord causing paralysis	S24

Dislocation

Depending on the body region, dislocation injuries are rated into RAPEX severity level 2 to 4. Similarly, ICD dislocation codes are also structured based on body region, therefore the codes are easily mapped into RAPEX system.

Dislocation		
1	-	
2	Extremities (finger, toe, hand, foot), elbow, jaw, loosening of tooth	S03 (.0-.3), S23 (.0-.4), S33 (.0-.4), S43 (.0-.3), S 3.1, S83.4, S93.4
3	Ankle, wrist, shoulder, hip, knee, spine	S83.40, S83.41, S83.42, S83.50, S83.51, S83.52
4	Spinal column	S13(.4-.6), S83.43, S83.44, S83.53, S83.54

Sprain and strain

Depending on the body region, sprain and strain injuries are rated into RAPEX severity level 1 to 4. Similar to dislocation group, ICD sprain and strain are also structured based on body region. Therefore the application of RAPEX severity level into ICD codes is easily performed.

Sprain or strain, musculoskeletal disorder		
1	Extremities, joints, spine (no dislocation or fracture)	S03 (.4-.5), S23 (.3-.5), S33 (.5-.7), S43 (.4-.7), S53.4, S63 (.5-.6), S73.1, S83.4, S93.4
2	Knee ligament strain	S83.40, S83.41, S83.42, S83.50, S83.51, S83.52
3	Ligament or tendon rupture/tear, muscle tear, whiplash	S13(.4-.6), S83.43, S83.44, S83.53, S83.54
4	-	

Entrapment, Pinching

Entrapment or pinching is coded as external cause under ICD code W23 (Caught, crushed, jammed or pinched in or between objects). Injury code for this hazard is assigned based on the type of injury sustained (e.g. laceration, fracture, superficial, etc).

Entrapment/pinching		
1	Minor pinching	
2	-	
3	[use as appropriate the final outcomes of bruising, crushing, fracture, dislocation, amputation, as applicable]	
4	[same outcome as for suffocation/strangulation]	

Crushing injury

Crushing injury is defined in the ACS (p.284, 2008) as an "external comprehensive force which has been applied to a body region for a period of time which may result in damage to underlying anatomical structures and lead to serious systemic consequences". In an event of crushing injury where the consequence of the crushing mechanism is known (e.g. contusion, fracture, dislocation, or internal injury), the injury will be coded under the appropriate type of injury.
However, if no other injury is documented; crushing injury is rated under RAPEX severity level 3 or 4 depending on the body region. Specific body region crushing injury codes are also available in ICD.

Crushing		
1	-	
2	-	
3	Extremities (finger, toe, hand, foot), elbow, ankle, wrist, forearm, leg, shoulder, trahea, larynx, pelvis	S17, S47, S57, S67, S77, S87, S97, T04
4	Spinal cord mid-low neck chest (massive crushing) brain stem	S28, S38, T04.1

Fracture

Depending on the body region, fracture injuries are rated into RAPEX severity level 3 to 4. Similar to sprain, strain and dislocation injuries, ICD fracture codes are also structured based on body region. Therefore the application of RAPEX severity level into ICD codes is easily performed.

Fracture		
1	-	
2	Extremities (finger, toe, hand, foot), wrist, arm, rib., sternum, nose, tooth, jaw, bones around eye	S02 (.2-.6), S42, S52, S62, T02(.2, .4), T10, T92(.1–.2)
3	Ankle, leg (femur and lower leg), hip, thigh, skull, spine (minor compression fracture), jaw (severe), larynx, multiple rib fractures - blood or air in chest	S02 (.0-.1, .7), S12 (.8-.9), S22, S32, T02.1, S73.0, S82
4	Neck, spinal column	S12 (.0 -.7)

Ingestion

Ingestion in this instance is referring to ingestion of foreign body instead of ingestion of substance (poisoning). Any ingestion of foreign body is rated under RAPEX severity level 3 or 4 depending on level of the damage caused in the internal organ. Where ingestions are causing obstruction in internal airway or digestive tract, ingestions are rated as severity level 3. If permanent damage is diagnosed, ingestions are rated as severity level 4. For these two levels, the presence of foreign body in digestive (alimentary) tract is coded under T18 or T17 if the foreign body stuck in respiratory tract. If an internal injury (e.g. perforation or open wound) is identified, a code from S36 group is applied depending on the site in the digestive system.

Ingestion		
1	-	
2	-	
3	Internal organ injury (refer also to internal airway obstruction where the ingested object gets stuck high in the oesophagus)	T17, T18
4	Permanent damage to internal organ	S36.4, S36.5, S36.8

Choking (Internal airway obstruction + Suffocation/Strangulation

Similar to entrapment and pinching, choking is regarded as an external cause rather than the injury type in ICD coding. ICD codes under W80 for Inhalation and ingestion of other objects causing obstruction of respiratory tract are used to indicate choking injury. The consequences of choking mechanism are coded under T17 for foreign body obstruction in airway or T71 for Asphyxiation.

Choking injuries under RAPEX, are rated at severity level 3 and 4 depending on whether or not the injury cause permanent damage or not. In ICD coding however, the status of permanent damage is not coded. Therefore, when RAPEX ratings were applied to ICD coded injury data, RAPEX severity level 3 and 4 were unable to be differentiated.

Choking | Internal airway obstruction + Suffocation/Strangulation		
1	-	
2	-	
3	Oxygen flow to brain blocked without permanent consequences	T17, T71
4	Oxygen flow to brain blocked without permanent consequences Fatal suffocation/strangulation	T17, T71

Amputation

Depending on the body region, amputation injuries are rated into RAPEX severity level 3 to 4. Similar to fracture, sprain, strain and dislocation injuries, ICD fracture codes are also structured based on body region. Therefore the application of RAPEX severity level into ICD codes is easily performed.

Amputation		
1	-	
2	-	
3	Finger(s), toe(s), hand, foot (part of) arm, leg, eye	S48, S58, S68, T05(.0, .2), T11.6, S78(.1–.9), S88, S98, T05(.3, .5), T13.6
4	both extremities	S78.0, T05

Submersion/ Drowning

Fatal drowning is rated at RAPEX severity level 4. Other conditions of drowning or submersion are not rated in the guide. In ICD on the other hand, T75.1 is used to code fatal and non-fatal submersions.

Electric Shock

Electric shock injuries are rated under RAPEX severity level of 1, 2 or 4 depending on the consequences of the electric shock. If the shock causes burn, the condition is rated using burn severity rating (see burn section). Muscle paralysis or cramp from electric shock is rated as level 2. Electrocution as the most severe outcome is rated as level 4. Similar to submersion and drowning coding, ICD does not differentiate the differences in the outcome of electric shock, and all are coded under T75.4.

Electric shock		
1	[see also under burns as electric current can cause burns]	
2	local effects (temporary cramp or muscle paralysis)	
3	-	
4	Electrocution	T75.4

Poisoning from substances

RAPEX severity ratings for poisoning are ordered based on the outcome of poisoning into severity level 1 to 4, whereas ICD poisoning codes are structured based on the type of substance.

Poisoning | Poisoning from substance (ingestion, inhalation, dermal)		
1	Diarrhoea, vomitting, local symptoms	T36 - T65
2	Reversible damage to internal organs e.g. liver, kidney, slight haemolytic, anaemia	T36 - T65
3	Irreversible damage to internal organs e.g. oesophagus, stomach, liver, kidney, haemolytic, anaemia, reversible damage to neve system	T36 - T65
4	Irreversible damage to nerve system	T36 - T65

Irritation, dermatitis (including inflammation or corrosive effect of substance - inhalation, dermal)

Similar to poisoning, RAPEX severity ratings for irritation and dermatitis from contact with substances are ordered based on the degree of irritations and whether or not the condition is reversible. Effect of substance on lung which requires respiratory assistance is rated as level 4. ICD codes for toxic effect are outlined based on the type of substance, therefore are not compatible to support the classification in the RAPEX system for this injury type.

Irritation, dermatitis | inflammation or corrosive effect of substance (inhalation, dermal)		
1	Local slight irritation	
2	Reversible eye damage reversible systemic effects inflammatory effects	
3	Lungs, repiratoy insufficiency, chemical pneumonia irreversible systemic effects partial lost of sight corrosive effects	
4	Lungs, require respiratory assistance asphyxia	T71

Eye Injury, foreign body in eye

Foreign body in eye and eye injuries are rated under RAPEX severity level 1 to 4 depending on the presence and the degree of loss of sight. Eye injuries are coded under code S05 group in ICD injury coding. The status of loss of sight however is not coded under injury chapter, but under H54 in disease of eye chapter, which are differentiated based on the distance visual acuity. Due to this differences in criteria used in both classifications, ICD is not compatible to support RAPEX system for this injury type.

Blinding | Eye injury, foreign body in eye		
1	Temporary pain in eye without need for treatment	S05
2	Temporary loss of sight	H54.0
3	Partial loss of sight, permanent loss of sight (one eye)	H54.0
4	Permanent loss of sight (both eyes)	H54.0

Hearing injury, foreign body in ear

Similar to eye injury, foreign body in ear and hearing injuries are rated under RAPEX severity level 1 to 4 depending on the presence and the degree of loss of hearing. Injuries to ear and auditory structures are coded under code S01.3 group in ICD injury coding. The status of hearing loss however is not coded under injury chapter, but under H91 in disease of ear and mastoid chapter, which are differentiated based on the type of healing loss (i.e. ototoxic, sudden idiopathic, deaf mutism or other). Due to this differences in criteria used in both classifications, ICD is not compatible to support RAPEX system for this injury type.

Hearing | Hearing injury, foreign body in ear		
1	Temporary pain in ear without need for treatment	S01.3, H91
2	Temporary impairment of hearing	S01.3, H91
3	Partial loss of hearing, complete loss of hearing (one ear)	S01.3, H91
4	Complete loss of hearing (both ears)	S01.3, H91

Piercing, puncturing

In ICD coding, similar to choking, piercing and puncturing are regarded as external causes of injury rather than the injury type. ICD codes under W45 or W49 for body piercing and other inanimate mechanical forces are used to these types of injury. The consequences of piercing or puncturing mechanism are coded under S21 which is related to open wound or laceration. If the mechanism penetrate to internal organ, S31 codes are used and S05 for piercing or puncturing of the eye.

Piercing, puncturing		
1	Limited depth, only skin involved	
2	Deeper than skin, abdominal wall (no organ involvement)	S21
3	Eye, internal organs, chest wall	S21, S31, S05
4	Aorta, heart, bronchial tube, deep injuries in organs (liver, kidney, bowel, etc)	S26.88

Concussion

Concussions are classified specifically under the RAPEX rating system. Depending on the duration of loss of consciousness, concussive injuries are rated under level 2 to 4. Similarly, intracranial injury concussions are coded based on duration of loss of consciousness (i.e. brief - less than 30 minutes, moderate - 30 minutes to 24 hours and prolonged - more than 24 hours). Therefore, the similarities in both classifications present an advantage to map ICD codes into RAPEX severity ratings.

Concussion (RAPEX only)		
1	-	
2	Very short unconsciousness (minutes)	S06 (.02-.03)
3	Prolonged unconsciousness	S06.04
4	Coma	S06.05
Unclassifiable	unspecified duration	S06(.00 -.01)

Neurological disorder

RAPEX identifies neurological disorder as an injury hazard. There's only one condition listed in the RAPEX guide for triggered epileptic seizure. This condition is rated as severity level 3. Based on ICD however, this condition is not coded under the injury chapters. It is treated as a disease under nervous system chapter. The codes for epileptic seizure are under G40 with third and forth characters to distinct specific types of epileptic seizure.

Allergic reaction or sensitisation

Similar to irritation and dermatitis from contact with substances, RAPEX severity ratings for allergic reaction and sensitisation are ordered based on the degree of reaction (mild, widespread and anaphylactic). In ICD coding, allergic reactions are classified under the skin and subcutaneous chapter instead of injury chapter, under the code group L23. However, for anaphylactic reactions are coded under adverse effect group T78.

Allergic reaction or sensitisation (RAPEX only)		
1	Mild or local allergic reaction	
2	allergic reaction, widespread allergic contact dermatitis	L23.9
3	Strong sensitisation, provoking allergies to multiple substances	
4	Anaphylactic reaction, shock, fatality.	T78.0, T78.2

Long term damage from contact with substances or from exposure to radiation

Long term damage from contact with substance is classified specifically under RAPEX severity rating. The conditions are differentiated into severity level 1 to 4 based on the symptoms. Local sysmptoms (i.e. diarrhoea and vomiting) are classify as severity level 1, damage in internal organ as level 2 and damage to nervous system as level 3. The most severe level (4) is for long term damage associated with cancer, depression and reproduction system. All these conditions are coded under related body system chapter in ICD.

Long-term damage from contact with substances or from exposure to radiation (RAPEX only)		
1	Diarrhoea, vomiting, local symptoms	A09.9, R11
2	reversibile damage to internal organs, e.g. liver, kidney, slight haemolytic anaemia	T14.9
3	Damage to nervous system, e.g. Organic Psycho Syndrome (OPS; also called Chronic Toxic Encephalopathy, lso known as 'painters'disease). Irreversible damage to internal organs, e.g. oesophagus, stomach, liver, kidney, haemolytic anaemia, reversible damage to nervous system	
4	Cancer (leukaemia), effects on reproduction, effects on offspring, CNS depression	C95, F20

Microbial infection

RAPEX identifies microbial infection as another injury hazard. The condition is rated from severity level 2 to 4 depending on the reversibility of the damage and fatal outcome. The condition however is not coded under injury chapter, depending on the type of microorganism, the condition are coded under infectious and parasitic diseases chapter.

Microbial infection (RAPEX only)		
1	-	
2	reversible damage	
3	irreversible effects	
4	Infection requiring prolonged hospitalisation, antibiotics-resistant organisms, Fatality.	

Conclusion

RAPEX Injury Type	Alignment with ICD-10-AM
Burn (with result)	Well aligned
Laceration (Open wound)	Partially aligned
Superficial	Partially aligned
Dislocation	Well aligned
Sprain and strain	Well aligned
Entrapment, Pinching	Poorly aligned
Crushing injury	Partially aligned
Fracture	Well aligned
Ingestion	Poorly aligned
Choking (Internal airway obstruction + Suffocation/Strangulation	Poorly aligned
Amputation	Well Aligned
Submersion/ Drowning	Partially aligned
Electric Shock	Poorly aligned
Poisoning from substances	Poorly aligned
Irritation, dermatitis (including inflammation or corrosive effect of substance - inhalation, dermal)	Poorly aligned
Eye Injury , foreign body in eye	Poorly aligned
Piercing, puncturing	Poorly aligned
Concussion	Well aligned
Neurological disorder	Poorly aligned
Allergic reaction or sensitisation	Poorly aligned
Long term damage from contact with substances or from exposure to radiation	Poorly aligned
Hearing injury, foreign body in ear	Poorly aligned
Microbial infection	Poorly aligned

Appendix 9
Product Types based on RAPEX Application in QISU Burn data

Product-related burn cases (n=798)

Product types based on MIF codes	RAPEX Severity Rating			Total
	Below severity threshold	Above severity threshold	Unclassifiable	
Appliance	**70**	**227**	**96**	**393**
Cooking appliance (incl. Stove, oven, cook-top, bbq)	46	121	60	227
Electric kettle or jug	3	4	2	9
Heating appliance (incl. Space heater, electric radiator, slow combustion heater, etc)	5	26	7	38
Iron, other heated clothes pressing appliance (steam other)	7	46	15	68
Other or unspecified appliance 03	9	29	12	50
Refrigerator, freezer		1		1
Chemical substance	**23**	**45**	**37**	**105**
Acid	2		2	4
Bleach, caustic (includes ammonia)	3	5	4	12
Dishwasher detergent	1			1
Ointment, topical medicine, lineament		1		1
Other or unspecified chemical substance (excl. Drug,medic.)	7	15	16	38
Paint, paint thinner (includes turpentine), paint stripper	1	2	1	4
Petrol, other petroleum distillate (eg. Kerosene, diesel)	4	21	11	36
Soap, detergent, cleaning compounds (excl. Dish wash.det.)	5	1	3	9
Personal use item	**18**	**28**	**23**	**69**
Hot oil or fat	18	27	22	67
Jewellery			1	1
Other clothing		1		1
Furnishing	**3**	**4**	**2**	**9**
Bed (excludes bunk bed & cot)	1			1
Other unspecified furnishing		4	1	5
Rug, mat, loose carpet	1		1	2
Sofa, couch, lounge, divan, etc	1			1
Infant or child's product	**2**	**5**	**3**	**10**
Other or unspecified infant's or child's product			1	1
Other playground equipment		1		1
Other product intended for infant / child care		2		2
Other toy	1	1	1	3
Slide, sliding board	1	1	1	3
Miscellaneous	**3**	**8**	**2**	**13**
Fireworks	3	6	2	11
Rope or string		2		2
Sporting equipment	**7**	**22**	**12**	**41**
Ball			1	1
Other or unspecified sporting equipment	7	22	11	40
Structure or fitting		**1**		**1**

Product types based on MIF codes	RAPEX Severity Rating			Total
	Below severity threshold	Above severity threshold	Unclassifiable	
Toilet bowl, cistern, associated plumbing		1		1
Tool	**9**	**8**	**6**	**23**
Fixed plant/machinery other or unspecified	1		1	2
Other or unspecified tool	1	2	3	6
Power tool: drill		1		1
Power tool: grinder, buffer, polisher		1		1
Power tool: other or unspecified		1	1	2
Welding equipment	7	3	1	11
Transport	**15**	**44**	**34**	**93**
3 or 4 wheel motorbike / atv	1	1	4	6
Bicycle		1	4	5
Lawn mower (power or manual)	3	7	2	12
Mobile machinery other or unspecified			1	1
Vehicle part, fitting or accessory	11	35	23	69
Utensil or container	**12**	**15**	**14**	**41**
Cutlery, food preparation, utensil (excl. Knife)	1	6	1	8
Drinking glass	1	1		2
Other or unspecified utensil or container	10	7	13	30
Waste container, rubbish basket, refuse bin		1		1
Total product-related burn cases	**162**	**407**	**229**	**798**

Appendix 10: Medical Record Review Search Criteria for burns and falls

<u>Burn cases</u>

Required 100 cases (or all cases if less than 100) per hospital (Logan Hospital, RCH, Gold Coast Hospital and Mackay Hospital). Total 400 burn cases.

Year 2008 – 2010

AND

Age 0 – 17 years old

AND

ICD-10-AM External cause codes (product related):
X00, X02, X03, X04, X05, X06, X08, X09, X12, X13.0, X13.8, X13.9, X15 Include all fourth digits (.0 - .9), X16, X17, X18, X19

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product flag
X00	Exposure to uncontrolled fire in building or structure	building or structure	clothes clothing with conflagration, building burning (uncontrolled fire), structure burning (uncontrolled fire), fittings or furniture (in building or structure) (uncontrolled),	**Consumer product**
X02	Exposure to controlled fire in building or structure	building or structure	building or structure (controlled), brazier (in building or structure), fireplace, furnace or stove (charcoal) (coal) (coke) (electric) (gas) (wood), fire stove	**Consumer product**
X03	Exposure to controlled fire, not in building or structure	-	bonfire campfire (controlled), trash fire (controlled), brazier (not in building or structure)	**Consumer product**
X04	Exposure to ignition of highly flammable material	highly flammable material	highly flammable material (357enzene) (fat) (gasoline) (kerosene) (paraffin) (petrol), highly flammable material, apparel from highly flammable material, gasoline, kerosene, paraffin, petrol	**Consumer product**
X05	Exposure to ignition or melting of nightwear	nightwear	nightwear (gown, nightclothes, nightdress, pajamas, robe)	**Consumer product**
X06	Exposure to ignition or melting of other clothing and apparel	clothing and apparel	clothes clothing (from controlled fire), apparel, jewelry (plastic)	**Consumer product**
X08	Exposure to other specified smoke, fire and flames	-	bed, bed linen, blowtorch, candle, cigar or cigarette, lamp (flame), lighter (cigar) (cigarette), matches, mattress, pipe (hot) smoking, torch welding, bed (bed clothes) (bed linen) (mattress) (pillows) (sheets) (spreads)	**Consumer product**
X09	Exposure to unspecified smoke, fire and flames	smoke, fire, flames	fire resulting from lightning, smoke, fire, flames	**Consumer product**
X12	Contact with other hot fluids	hot fluids	hot fluid, hot liquid, hot water heated on stove, liquid (boiling) (hot), substance (hot) boiling	**Consumer product**
X13.0	Contact with steam and hot vapours from motor vehicle radiators	steam and hot vapors		**Consumer product**
X13.8	Contact with steam and hot vapours from other sources	steam and hot vapors		**Consumer product**
X13.9	Contact with unspecified steam and hot vapours	steam and hot vapors		**Consumer product**
X15	Contact with hot household appliances	hot household appliances	cooker (hot), heat from appliance (electrical) (household), hot household appliance, hot kettle, hot plate, hot saucepan (glass) (metal), hot stove (kitchen), hot toaster, hotplate, iron (hot)	**Consumer product**
X15.0	Contact with hot stove, oven or cook-top	Hot stove, oven or cook-top	cook (hot), cooker, plate, stove (kitchen), hotplate, grill (as part of oven)	**Consumer product**
X15.1	Contact with hot saucepan or frying pan	Hot saucepan or frying pan	baking pan (hot), frying pan (hot), saucepan (hot)(metal)(glass)	**Consumer product**
X15.2	Contact with hot toaster	Hot toaster	toaster (hot)	**Consumer product**
X15.3	Contact with hot kettle	Hot kettle	kettle (hot)	**Consumer product**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product flag
X15.4	Contact with hot clothes iron or press	Hot clothes iron or press	clothes press, iron (hot), clothes iron	**Consumer product**
X15.5	Contact with hot barbeque	Hot barbeque	barbeque (hot)	**Consumer product**
X15.8	Contact with other specified hot household appliance	Household appliance	cafe grill, hair appliance, household appliance (specified), sandwich toaster, waffle maker	**Consumer product**
X15.9	Contact with unspecified hot household appliance	Household appliance	Household appliance	**Consumer product**
X16	Contact with hot heating appliances, radiators and pipes	hot heating appliances, radiators and pipes	electric blanket, heat from appliance (electrical) (household) heating, heating appliance radiator or pipe, hot pipe, hot radiator, heating pad (electric), electric heating apparatus,	**Consumer product**
X17	Contact with hot engines, machinery and tools	hot engines, machinery and tools	engine (hot), hot machinery, hot tool	**Consumer product**
X18	Contact with other hot metals	hot metals	hot metal (liquid) (molten)	**Consumer product**
X19	Contact with other and unspecified heat and hot substances	heat and hot substances	hot object (not producing fire or flames), hot substance	**Consumer product**

Fall cases

Required 100 cases (or all cases if less than 100) per hospital (Logan Hospital, RCH, Gold Coast Hospital and Mackay Hospital). Total 400 fall cases.

Year 2008 – 2010

AND

Age 0 – 17 years old

AND

ICD-10-AM External cause codes (product related):
W01.1, W02 Include all fourth digits (.0 - .9), W05, W06 Include all fourth digits (.0 - .9), W07 Include all fourth digits (.0 - .9), W08 Include all fourth digits (.0 - .9), W09 Include all fourth digits (.0 - .9), W11, W12, W17.4

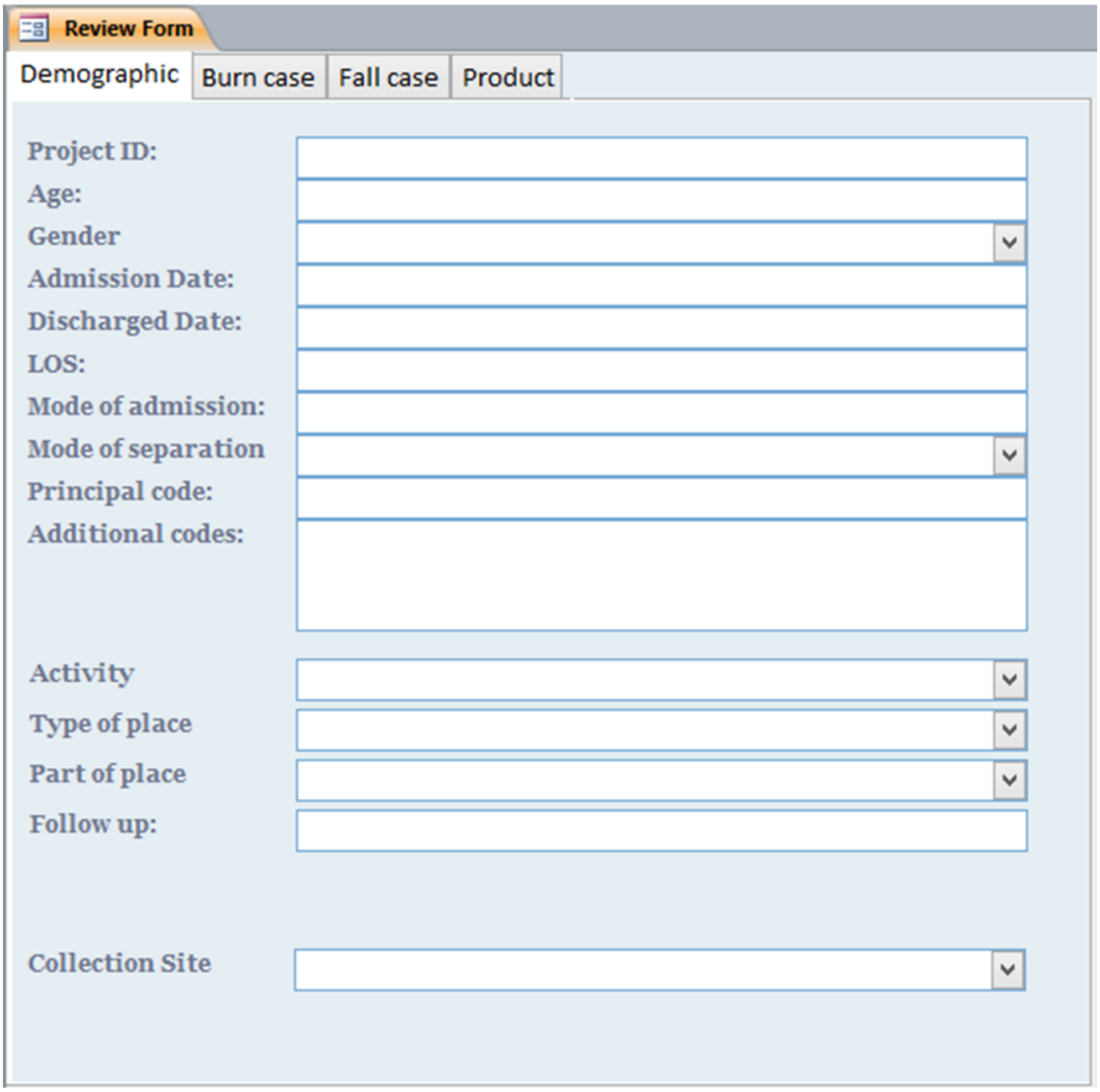
ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product flag
W01.1	Fall on same level from tripping	person, animals, objects and other projections and indentations		**Possible product**
W02	Fall involving ice-skates, skis, roller-skates or skateboards	ice-skates, skis, roller-skates or skateboards	skis, sled, skateboard, skates (ice) (roller)	**Consumer product**
W02.0	Fall involving roller-skates	Roller-skates	roller blades, roller-skates, rollerski, skates (in-line)(roller),	**Consumer product**
W02.1	Fall involving skateboard	Skateboard	skateboard(s),	**Consumer product**
W02.2	Fall involving water ski	Water ski	ski(s)(water), roller blades, roller-skates, rollerski,	**Consumer product**
W02.3	Fall involving snow ski	Snow ski	ski(s)(snow), ski(ing),	**Consumer product**
W02.4	Fall involving snow board	Snow board	snowboard, snow board,	**Consumer product**
W02.5	Fall involving ice-skates	Ice skates	skates (ice), ice (with skates),	**Consumer product**
W02.6	Fall involving scooter, nonpowered	Scooter, non-powered	scooter(kick)(nonpowered)	**Consumer product**
W02.7	Fall involving baby carriage	Baby carriage	stroller, pram, baby (carriage), pusher	**Consumer product**
W02.8	Fall involving baby walker	Baby walker	baby (walker)	**Consumer**

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product flag
				product
W02.9	Fall involving other and unspecified pedestrian conveyance	Pedestrian conveyance	shopping trolley, gopher, sandboard, scooter(s)(mobility)(powered)	Consumer product
W05	Fall involving wheelchair	wheelchair	wheelchair (electric) (nonpowered) (powered)	Consumer product
W06	Fall involving bed	bed	bed	Consumer product
W06.0	Fall involving bunk bed	Bunk bed	bunk(middle)(top)	Consumer product
W06.1	Fall involving special purpose bed	Special purpose bed	bed (hospital, orthopaedic, special purpose)	Consumer product
W06.2	Fall involving cot	Cot	cot, crib	Consumer product
W06.3	Fall involving bassinet	Bassinet	baby (capsule), bed (bassinet)	Consumer product
W06.4	Fall involving cradle	Cradle	cradle	Consumer product
W06.5	Fall involving hammock	Hammock	hammock (baby)	Consumer product
W06.6	Fall involving conventional bed	Conventional bed	bunk bed (bottom), bed (conventional, double, king, queen, single)	Consumer product
W06.8	Fall involving other specified bed	Bed	bed (camp, folding, futon, loft, sofa, stretcher, waterbed)	Consumer product
W06.9	Fall involving unspecified bed	Bed	bed	Consumer product
W07	Fall involving chair	chair	chair	Consumer product
W07.0	Fall involving rocking chair	Rocking chair	chair (gliding, rocking)	Consumer product
W07.1	Fall involving folding chair	Folding chair	chair (camp, folding)	Consumer product
W07.2	Fall involving revolving chair	Revolving chair	chair (revolving (on castors), swivel)	Consumer product
W07.3	Fall involving stool	Stool	stool (on castors)(revolving)	Consumer product
W07.4	Fall involving high-chair	High-chair	high (on castors), high-chair (on castors)	Consumer product
W07.5	Fall involving bath chair	Bath chair	chair (bath, shower)	Consumer product
W07.6	Fall involving commode chair	Commode chair	chair (commode)	Consumer product
W07.7	Fall involving lift assistance chair	Lift assistance chair	chair (lift assistance, smokey dawson)	Consumer product
W07.8	Fall involving other specified chair	Chair	bench seat, chair (arm, bench, dining, kitchen, specified, couch, divan, lounge,sofa)	Consumer product
W07.9	Fall involving unspecified chair	Chair	chair	Consumer product
W08	Fall involving other furniture	other furniture	furniture, table	Consumer product
W08.0	Fall involving baby change table	Baby change table	baby change table	Consumer product
W08.1	Fall involving baby exerciser	Baby exerciser	baby (exerciser), bouncinette	Consumer product
W08.2	Fall involving table	Table	table	Consumer product
W08.8	Fall involving other specified furniture	Furniture	furniture (specified)	Consumer product
W08.9	Fall involving unspecified furniture	Furniture	furniture	Consumer product
W09	Fall involving playground equipment	playground equipment	playground equipment	Consumer product
W09.0	Fall involving tree house	Tree house	play house, tree house	Consumer product
W09.1	Fall involving flying fox	Flying fox	Flying fox	Consumer product

ICD-10 Code	ICD-10 Code Description	Objects in ICD-10 code description	Objects in index directing to ICD-10 code	Product flag
W09.2	Fall involving playground climbing apparatus	Climbing apparatus	Climbing apparatus, jungle gym, monkey bar	**Consumer product**
W09.3	Fall involving slide	Slide	slide, sliding board,	**Consumer product**
W09.4	Fall involving swing	Swing	swing (set)	**Consumer product**
W09.5	Fall involving seesaw	Seesaw	seesaw, teeter totter	**Consumer product**
W09.6	Fall involving trampoline	Trampoline	trampoline	**Consumer product**
W09.8	Fall involving other specified playground equipment	Playground equipment	Playground equipment (specified)	**Consumer product**
W09.9	Fall involving unspecified playground equipment	Playground equipment	Playground equipment	**Consumer product**
W11	Fall on and from ladder	ladder	ladder, stepladder	**Consumer product**
W12	Fall on and from scaffolding	scaffolding	scaffolding	**Consumer product**
W16.1	Diving or jumping into water striking or hitting wall or diving board	Diving board, wall		**Consumer product**
W16.9	Other and unspecified contact when diving or jumping into water causing injury other than drowning or submersion	-	in water	**Possible product**
W17.4	Fall into empty swimming-pool	Swimming-pool	hot tub (empty), jacuzzi (empty), spa (empty), swimming pool (empty)	**Consumer product**

Appendix 11: Medical Record Review Data Collection Form

Form 1



Review Form

Demographic | Burn case | Fall case | Product

Project ID:

Age:

Gender

Admission Date:

Discharged Date:

LOS:

Mode of admission:

Mode of separation

Principal code:

Additional codes:

Activity

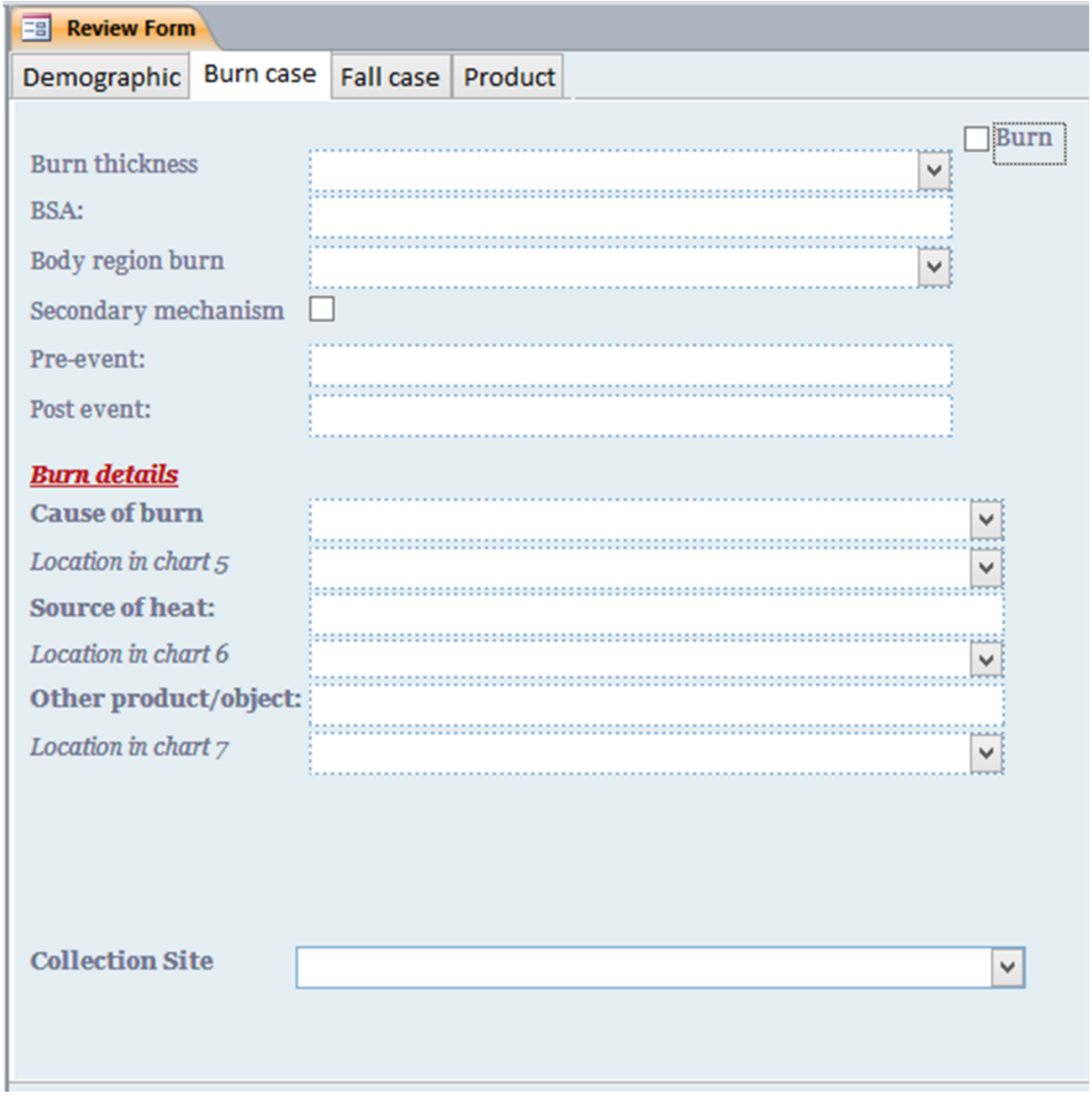
Type of place

Part of place

Follow up:

Collection Site

Form 2



Review Form

Demographic | Burn case | Fall case | Product

Burn

Burn thickness

BSA:

Body region burn

Secondary mechanism

Pre-event:

Post event:

Burn details

Cause of burn

Location in chart 5

Source of heat:

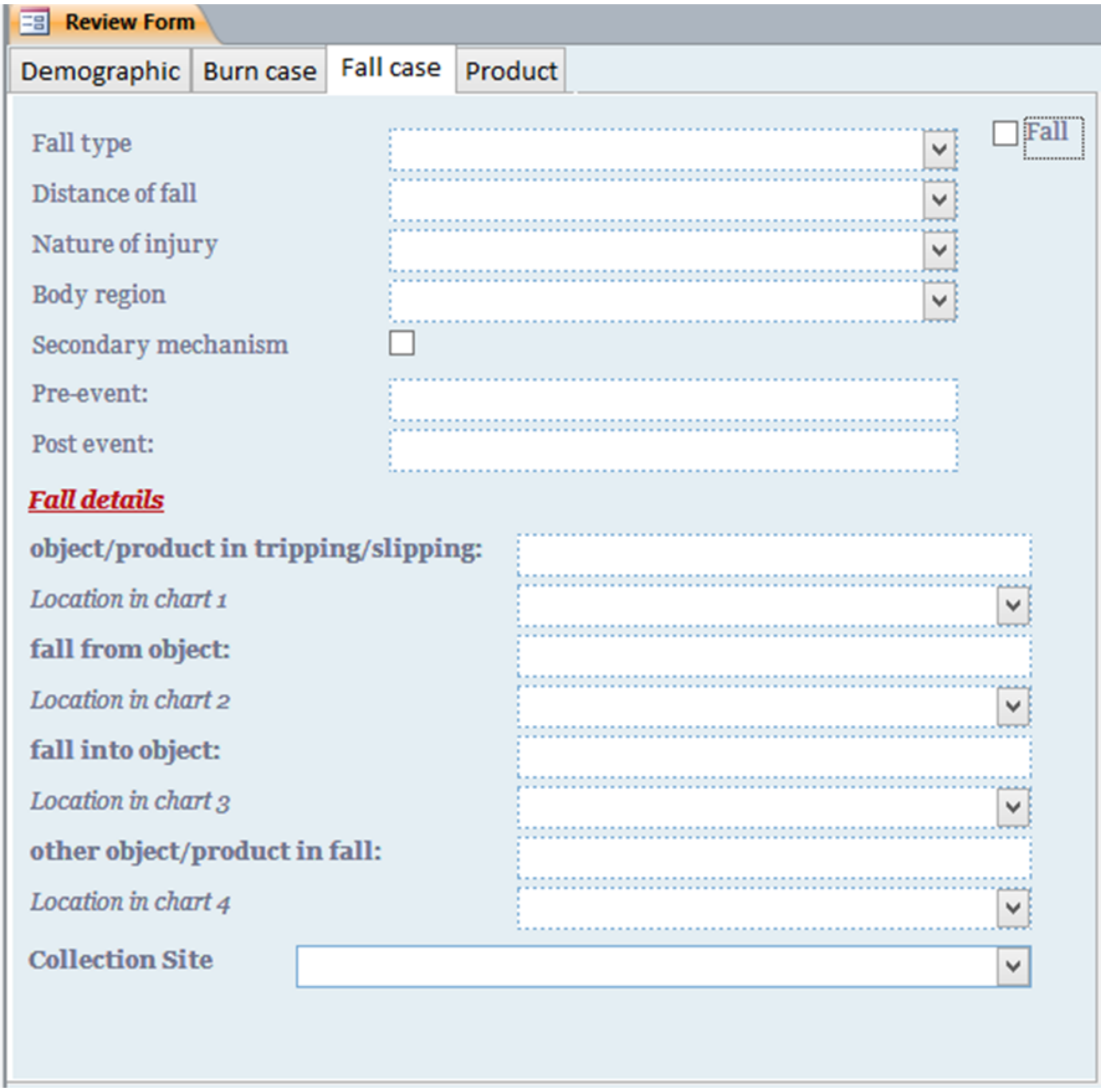
Location in chart 6

Other product/object:

Location in chart 7

Collection Site

Form 3



Review Form

Demographic | Burn case | Fall case | Product

Fall

Fall type

Distance of fall

Nature of injury

Body region

Secondary mechanism

Pre-event:

Post event:

Fall details

object/product in tripping/slipping:

Location in chart 1

fall from object:

Location in chart 2

fall into object:

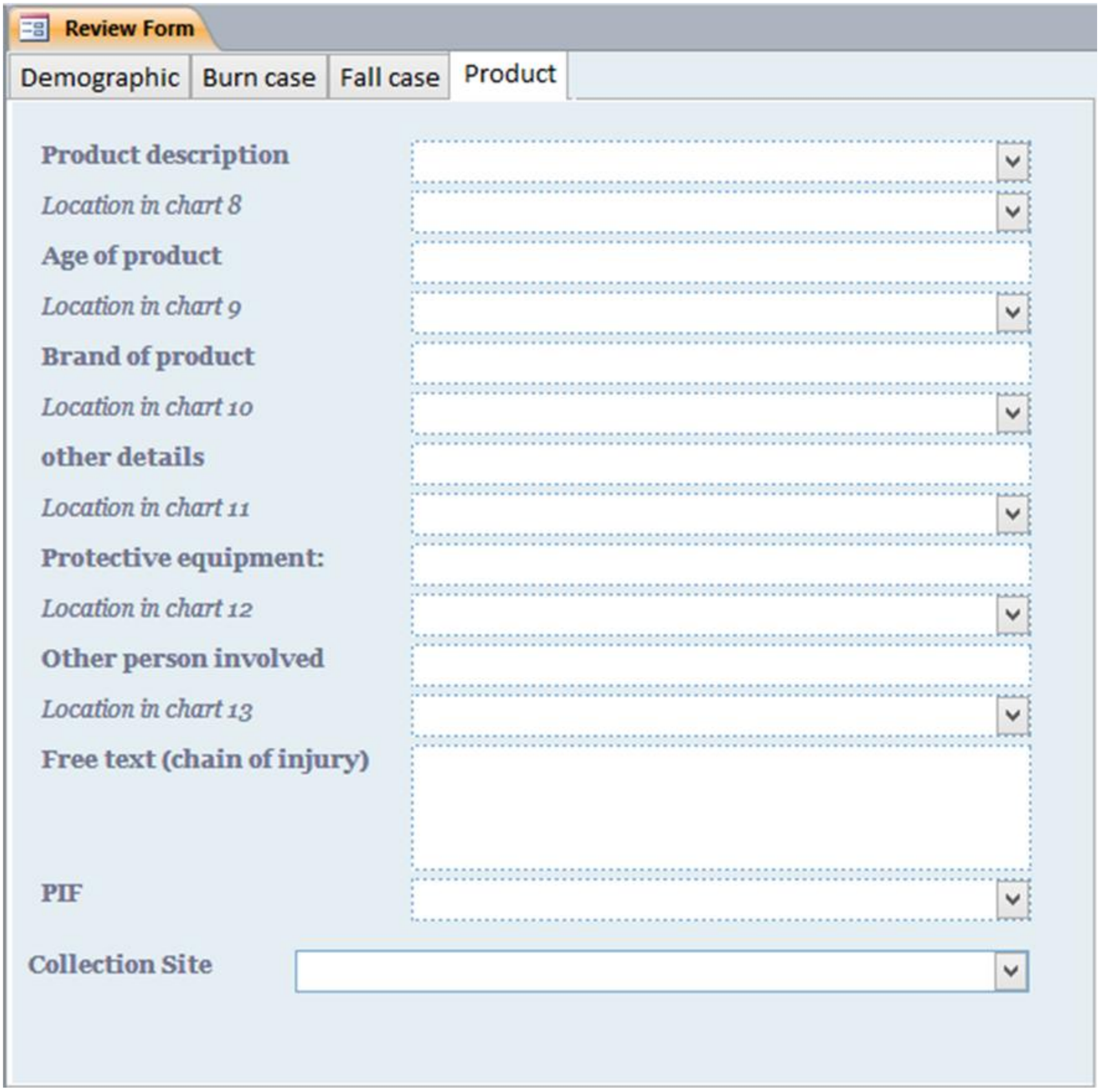
Location in chart 3

other object/product in fall:

Location in chart 4

Collection Site

Form 4



Review Form

Demographic | Burn case | Fall case | Product

Product description

Location in chart 8

Age of product

Location in chart 9

Brand of product

Location in chart 10

other details

Location in chart 11

Protective equipment:

Location in chart 12

Other person involved

Location in chart 13

Free text (chain of injury)

PIF

Collection Site

Appendix 12: Injury Scenario Table based on Product Involvement Factor

Product	Mechanism of injury	Possible scenario	PIF
Acetone	Chemical effect	*Ingestion of acetone*	Maladapted/misuse
Aerosol can	Burn	*Using aerosol can with fire/lighter/match*	Maladapted/misused
Air gun	Burn	*Burn from air gun*	High intrinsic risk
Air pump	Struck, hit by contact with object	*Hit by person with plastic air pump*	Maladapted/misuse
Axe	Crushing, piercing	*Was cutting with axe, missed object and cut self*	High intrinsic risk
	Struck, hit by contact with object	*Hit with axe*	High intrinsic risk
Baby barrier	Fall	*Fell off baby barrier*	Proximity
Baby capsule	Fall	*Fall from baby capsule without straps on*	Maladapted/misused
		Placed on other object/surface without seatbelt on, fall off	Possibly maladapted/misuse
Baby sling	Fall	*Fall off sling*	Proximity
Baby swing	Fall	*Fell form baby swing*	Identified but inadequate info
Baby walker	Fall	*Baby on walker, fell down stairs*	Proximity
		Fell out of baby walker	Identified but inadequate info
Bag	Struck, hit by contact with object	*Entrapment on bag's string*	Proximity
		Hit bag	Proximity
Balance beam	Fall	*Fall off balance beam*	Proximity
		Pushed off balance beam	Proximity
Ball	Fall	*Fall over while kicking ball*	Proximity
		Standing on ball, fall off	Proximity
		Tripped over ball	Proximity
Ball - baseball	Struck, hit by contact with object	*Hit by ball*	Proximity
Ball - basket	Acute over - exertion	*Inversion injury while playing with ball*	Proximity
		Jarred finger while playing with ball	Proximity
Ball - bowling	Acute over - exertion	*Crushed by bowling ball*	Proximity
	Struck, hit by contact with object	*Kicked bowling ball*	Proximity
Ball - cricket	Fall	*Fall while playing with cricket ball*	Proximity
	Struck, hit by contact with object	*Caught ball awkwardly injury to hand*	Proximity
		Struck by cricket ball	Proximity
Ball - dodge	Fall	*Fall while playing with dodge ball*	Proximity
	Struck, hit by contact with object	*Hit by dodge ball*	Proximity
		Injured hand while playing dodge ball	Proximity
Ball - football	Acute over - exertion	*Ankle injury while kicking football*	Proximity
		Finger injury playing football	Proximity
		Hip injury while kicking football	Proximity
		Injury to knee while playing football	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Ball – football (cont.)	Fall	*Hit ball and fell*	Proximity
	Struck, hit by contact with object	*Hit by ball*	Proximity
		Hit head with football	Proximity
		Injury to hand while playing football	Proximity
		Playing football hyperextension of finger	Proximity
		Playing football tackled down	Proximity
Ball – netball	Acute over - exertion	*Catching ball, injured finger*	Proximity
		Injured shoulder while plying netball	Proximity
	Fall	*Playing netball fall*	Proximity
	Struck, hit by contact with object	*Hit by ball*	Proximity
Ball - rugby	Struck, hit by contact with object	*Finger struck rugby ball*	Proximity
		Hit by ball	Proximity
Ball - shot put	Struck, hit by contact with object	*Dropped shot put ball on foot*	Proximity
Ball - small	Foreign body	*Swallowed ball*	Maladapted/misuse
Ball - soccer	Acute over - exertion	*Ankle injury playing soccer*	Proximity
		Hit toe while kicking ball	Proximity
		Tackled hit head with ball	Proximity
	Fall	*Fell over while playing soccer*	Proximity
		Slipped while playing soccer	Proximity
		Stood on ball and fell	Proximity
		Tripped on soccer ball	Proximity
	Struck, hit by contact with object	*Hit by ball*	Proximity
Ball - softball	Acute over - exertion	*Extended arm while throwing ball*	Proximity
		Injury to finger playing softball	Proximity
	Struck, hit by contact with object	*Hit by ball*	Proximity
Ball - speedball	Struck, hit by contact with object	*Injury to finger while playing speedball*	Proximity
		Injury to wrist playing speedball	Proximity
Ball - sport	Acute over - exertion	*Hit by ball*	Proximity
		Twisted ankle playing with ball	Proximity
		Wrist injury playing with ball	Proximity
Ball - tennis	Struck, hit by contact with object	*Hit by ball*	Proximity
Ball - toy	Fall	*Tripped over ball*	Proximity
Ball - unspecified	Acute over - exertion	*Hit by ball*	Proximity
		Injury to finger playing with ball	Proximity
		Twisted ankle playing with ball	Proximity
	Fall	*Fell over trying to catch ball*	Proximity
		Fell while kicking ball	Proximity
		Holding ball fell over	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Ball – unspecified (cont.)	Fall (cont.)	*Person fell on leg while playing with ball*	Proximity
		Stood on ball and fell	Proximity
		Tripped on ball	Proximity
		Twisted ankle playing with ball	Proximity
	Struck, hit by contact with object	*Caught ball awkwardly injury to hand*	Proximity
		Hit by ball	Proximity
Ball - volley	Acute over - exertion	*Twisted ankle playing with ball*	Proximity
	Struck, hit by contact with object	*Caught ball awkwardly injury to hand*	Proximity
		Hit by ball	Proximity
Balloon	Crushing, piercing	*Hit balloon, tripped, fell on object*	Proximity
	Suffocation	*Chewing balloon*	Maladapted/misuse
Bar	Fall	*Fall from bar*	Proximity
	Struck, hit by contact with object	*Hit on metal bar*	Proximity
		Struck by rolling metal bar	Identified but inadequate info
Barrel	Crushing, piercing	*Crushed by barrel*	Identified but inadequate info
Basket	Struck, hit by contact with object	*Fell over basket*	Proximity
Basketball hoop	Struck, hit by contact with object	*Hit by falling basketball hoop*	Defective
Bath oil	Chemical effect	*Ingestion of bath oil*	Maladapted/misuse
Battery	Foreign body	*Swallowed/ingestion of battery*	Maladapted/misuse
Battery - button	Foreign body	*Insert battery up nostril*	Maladapted/misuse
BBQ	Burn	*Burn BBQ plate*	High intrinsic risk
		Contact burn from bbq hot plate (while on/just recently turned off)	High intrinsic risk
Bead	Foreign body	*Bead lodged in nose*	Identified but inadequate info
	Struck, hit by contact with object	*Playing, put bead in ear*	Maladapted/misuse
Beam	Fall	*Fell off beam*	Proximity
	Struck, hit by contact with object	*Hit on beam*	Proximity
		Struck by falling beam	Identified but inadequate info
Bean bag	Acute over - exertion	*Tripped over bean bag*	Proximity
	Foreign body	*Insertion bead from bean bag to body part*	Identified but inadequate info
	Struck, hit by contact with object	*Diving into bean bag*	Proximity
Bed	Acute over - exertion	*Fell from bed*	Proximity
		Jump off bed	Proximity
		Pulled by person unto bed	Proximity
		Wrestling on bed landed awkwardly	Proximity
	Crushing, piercing	*Cut on sharp edges on bed*	Proximity
		Dropped sofa bed on foot	Proximity
		Finger caught in folding bed	Identified but inadequate info

Product	Mechanism of injury	Possible scenario	PIF
Bed (cont.)	Crushing, piercing (cont.)	*Hit side table after fell off bed*	Proximity
		Jump off bed, hit on object	Proximity
	Fall	*Fall off/rolled off/jumped off bed*	Proximity
		Fell into bedhead	Proximity
		Hit side table after fell off bed	Proximity
		Jump off bed	Proximity
		Rolled off bed	Proximity
		Tripped over, hit bed	Proximity
	Foreign body	*Splinter from bed*	Proximity
	Struck, hit by contact with object	*Climbed up bed, slipped*	Proximity
		Fell backwards off bed knocked head on bedframe	Proximity
		Fell off bed, hit on floor	Proximity
		Fell off bed, hit on table	Proximity
		Fell, hit on bed	Proximity
		Hit on bed	Proximity
		Jumping on bed fell off	Proximity
		Mattress fell on head	Identified but inadequate info
		Pushed off bed, hit on side table	Proximity
Bed, bunk	Fall	*Caught foot on bunk bed's ladder/railing*	Proximity
		Fall/jump off top/bottom/ladder of bunk bed	Proximity
Bench	Crushing, piercing	*Fell from bench, cut lip*	Proximity
	Fall	*Fall from bench*	Proximity
		Fall unto bench	Proximity
		Fell from bench unto other object	Proximity
		Fell from kitchen bench out of bumbo seat	Proximity
		Rolled off bench	Proximity
		Stood on bench, fall	Proximity
		Tripped over hit bench	Proximity
	Struck, hit by contact with object	*Fell over, hit on bench*	Proximity
		Hit on bench	Proximity
		Run into bench	Proximity
Bicycle	Acute over - exertion	*Fell from bike*	Identified but inadequate info
		Came off a jump	Identified but inadequate info
		Collision with another bike	Identified but inadequate info
		Fall from bike, riding downhill	Identified but inadequate info
		Hyperextending knee riding bike	Identified but inadequate info
		Jumped off a bike jump	Proximity
		Loading a bike, slipped off struck body part	Identified but inadequate info

Product	Mechanism of injury	Possible scenario	PIF
Bicycle (cont.)	Acute over – exertion (cont.)	*Riding bike*	Identified but inadequate info
		Riding bike hit handlebars	Identified but inadequate info
	Crushing, piercing	*Bike accident*	Identified but inadequate info
		Bike fell on body part	Identified but inadequate info
		Bike fell on finger cutting it	Identified but inadequate info
		Caught finger in bike	Identified but inadequate info
		Caught in bike chain	Identified but inadequate info
		Caught in bike wheel	Identified but inadequate info
		Caught in sprocket	Identified but inadequate info
		Caught on bike pedal	Identified but inadequate info
		Caught on foot peg	Identified but inadequate info
		Crushed finger caught on bike chain	Identified but inadequate info
		Fall from bike hit on body part	Identified but inadequate info
		Pedal flick into leg	Identified but inadequate info
		Puncture from brake handle on bike	Identified but inadequate info
		Puncture wound to shin from axel of push pike	Identified but inadequate info
		Toenail caught in bike	Identified but inadequate info
	Fall	*Wrist injury foosh*	Identified but inadequate info
		Attempting a stunt and fell off	Proximity
		Backwheel flipped out from under bike put hand out to break fall	Defective
		Doing a wheelie foot got stuck in pedal fell off	Proximity
		Fall from bike not knocked out	Identified but inadequate info
		Fall from bike when riding down hill	Proximity
		Fell from bike after going over jump	Proximity
		Fell off pushbike falling forward	Identified but inadequate info
		Fell over handlebars of bicycle going down ramp	Proximity
		Fell sideways off bicycle	Identified but inadequate info
		Fell/came off pushbike	Identified but inadequate info
		Foot slipped of pedal fell off	Proximity
		Riding bike at bike jumps fell off and landed on brake lever handle	Proximity
		Riding bike on track went over handle bars	Identified but inadequate info
		Riding bike ran over dogs fell off	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Bicycle (cont.)	Fall (cont.)	*Riding push bike mate on scooter did jump hit friends leg*	Proximity
		Rode bike down stairs	Identified but inadequate info
		Stopped too fast went over handlebars	Proximity
		Tripping over bike	Proximity
		Walking dog while riding bike dog ran in front of bike causing to fall off bike	Proximity
	Struck, hit by contact with object	*Bicycle seat v abdomen bike collided with a tree*	Proximity
		Bike fell on foot	Proximity
		Collided with another bicycle rider hit head on peddle	Proximity
		Fell off bike hit a bridge	Identified but inadequate info
		Fell off pushbike hitting bottom on bike frame	Identified but inadequate info
		Hit a pole while riding push bike	Proximity
		Passenger on handlebars of bicycle going downhill crashed into stationary car	Maladapted/misuse
		Push bike vs car	Identified but inadequate info
		Riding push bike downhill collided into side of car	Proximity
		Small tear on inside of vagina fell onto bar of bicycle	Identified but inadequate info
Billy cart	Fall	*Fell off home build billy cart*	Proximity
	Struck, hit by contact with object	*Caught under billy cart*	Proximity
		Pedal car went over foot	Proximity
Bin	Fall	*Tripped on bin lid and fell on face*	Proximity
Blade	Crushing, piercing	*Lac to r thumb with a banjo slicer in kitchen has been bleeding*	High intrinsic risk
		Laceration to palm from vege slicer	High intrinsic risk
		Stood on blade from food processor	High intrinsic risk
Blanket	Fall	*Fell over while walking with blanket*	Proximity
	Suffocation	*Respiratory apnoea have blanket over face*	Maladapted/misuse
Blinds	Crushing, piercing	*Metal blinds fell on head*	Defective
		Pushed into window blinds cut arm	Identified but inadequate info
Blower	Foreign body	*Foreign body in eye while using a blower*	Proximity
Board	Struck, hit by contact with object	*Hit against board*	Proximity
Bobby pin	Foreign body	*Foreign body bead from hair clip up nostril*	Identified but inadequate info
		Foreign body swallowed bobby pin	Maladapted/misuse
		Put a bobby pin in very deep in ear	Maladapted/misuse
Bogey board	Struck, hit by contact with object	*Head injury vs bogey board in surf*	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Book	Struck, hit by contact with object	*Hit by heavy book*	Proximity
		Hit in eye with book edge	Proximity
Boomerang	Struck, hit by contact with object	*Hit by boomerang thrown at nose*	Proximity
Booster chair	Fall	*Fall off booster seat sitting on table*	Maladapted/misuse
		Fell off booster chair	Identified but inadequate info
Bottle	Burn	*Grabbed hot water bottle*	Proximity
		Hot water bottle spilt	Inadequate description
	Crushing, piercing	*Drinking stumbled fell glass bottle hand broken laceration*	High intrinsic risk
		Dropped deodorant bottle and went to pick up glass	High intrinsic risk
		Fell onto broken glass bottle	High intrinsic risk
		Glass bottle fell onto foot	High intrinsic risk
		Stood on broken bottle	High intrinsic risk
	Struck, hit by contact with object	*Hit face with drink bottle*	High intrinsic risk
		Kicked a bottle of rocks fracture to foot	Proximity
Bouncer	Fall	*Fall out of rocker*	Identified but inadequate info
		Tripped from bouncer	Identified but inadequate info
Bouncy castle	Acute over - exertion	*Slid from castle hit head on rocks*	Proximity
Bowl	Burn	*Burn from hot noodles in bowl*	High intrinsic risk
		Burn from hot water in bowl	High intrinsic risk
		Burn from hot water in broken bowl	Defective
	Crushing, piercing	*Cut on glass bowl*	Proximity
		Cut on metal dog bowl	Proximity
		Glass dish fell on head	Proximity
	Struck, hit by contact with object	*Cut on glass bowl*	Proximity
		Hit on glass salad bowl	Proximity
Bowling pin	Fall	*Tripped on a bowling pin*	Proximity
Box	Acute over - exertion	*Lifted box and strained back*	Proximity
	Fall	*Fall by slipping over landed on corner of a box*	Proximity
		Fall from box	Proximity
	Struck, hit by contact with object	*Tripped over box*	Proximity
Bracket	Fall	*Fall hit on metal box*	Proximity
Bread roller	Crushing, piercing	*Hand caught in bread rollar*	Proximity
Bricks	Acute over - exertion	*Kicked bricks*	Proximity
	Fall	*Hit head on concrete block*	Proximity
		On top of letter box lost balance fell onto bessa block wall	Proximity
	Struck, hit by contact with object	*Bessa block fell on foot*	Proximity
Broom	Struck, hit by contact with object	*Fell onto broom stick*	Proximity
		Hit by broom stick	Maladapted/misuse

Product	Mechanism of injury	Possible scenario	PIF
Brush	Crushing, piercing	*Poked with paint brush*	Maladapted/misuse
Bucket	Burn	*Burn from hot water in bucket*	Proximity
	Fall	*Slipped in shower and hit chin on a plastic busket*	Proximity
Bunk bed	Fall	*Climbing on ladder on bunk bed fell*	Proximity
		Fall from bunk bed	Proximity
		Fall from lower bunk bed	Proximity
		Fall from top bunk bed	Proximity
		Fell off ladder for bunk beds	Proximity
	Struck, hit by contact with object	*Fell out of bunk bed hit teeth*	Proximity
		Hit head on metal part of bed	Proximity
Cabinet	Acute over - exertion	*Cabinet dropped on foot*	Proximity
	Crushing, piercing	*Caught fingers in drawer*	Proximity
		Caught under kitchen cupboard, jumped off bench	Proximity
		Crush injury on cabinet	Proximity
		Fell of a cabinet	Proximity
	Fall	*Fall against tv cabinet*	Proximity
		Fall from cube unto tv cabinet	Proximity
		Fall, hit head on cabinet	Proximity
		Fell off entertainment unit	Proximity
		Fell off kitchen bench	Proximity
		Slipped, hit cabinet	Proximity
	Struck, hit by contact with object	*Bumped head on cupboard*	Proximity
		Crushed little finger hand	Proximity
		Fell from cupboard	Proximity
		Fell from wooden box	Proximity
		Fell onto the edge of a cupboard	Proximity
		Jumping from chest of drawers	Proximity
		Pulled an object from cupboard, struck by object	Proximity
		Punched a cupboard during an argument has been drinking alcohol	Proximity
		Statue fell off cupboard onto patient	Proximity
		Struck/ran into the edge of a cupboard	Proximity
		Tall boy cupboard fell on patient	Proximity
Cable	Crushing, piercing	*Tripping on chord and striking staircase*	Proximity
Cap	Struck, hit by contact with object	*Hit by baseball cap*	Proximity
Car door	Crushing, piercing	*Crush injury slammed in car door*	Proximity
		Cut heel on car door	Proximity
		Jammed foot near gear stick in front of car	Proximity
		Slammed finger in car door	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Car doors (cont.)	Struck, hit by contact with object	*Accidently ran into car door*	Proximity
		Car door opened onto head	Proximity
		Slammed finger in car door	Proximity
		Striking head on boot of car	Proximity
Car seat	Acute over - exertion	*Click in arm as lifted out of car seat*	Proximity
	Burn	*Burn from hot car seat buckle*	Proximity
	Fall	*Fell out of car capsule onto concrete*	Identified but inadequate info
		Lifting up to put in car seat twisted and went face first into kerb	Proximity
Car wheel	Burn	*Burn from hot car wheel*	Proximity
Cardboard	Struck, hit by contact with object	*Caught in eye with cardboard*	Proximity
Carpet	Crushing, piercing	*Scraped toe on carpet and it cut toe*	Proximity
	Fall	*Fall onto carpet*	Proximity
		Jumped of truck tip landed on carpet which slipped in the wet	Proximity
		Stumbled/tripped on carpet	Proximity
Cart	Crushing, piercing	*Being pushed in push cart by other ren put foot out*	Proximity
CD	Struck, hit by contact with object	*Hit by other with a cd case*	Maladapted/misuse
Ceiling fan	Acute over - exertion	*Laceration from ceiling fan*	Proximity
	Crushing, piercing	*Being struck by a ceiling fan while jumping on top bunk bed*	Proximity
		Hit head on ceiling fan while on bunk bed	Proximity
		Hit on ceiling fan when climbing off bunkbed	Proximity
		Jumped off furniture and collided with ceiling fan	Proximity
		Laceration to head after hitting fan	Proximity
		Putting hand up to ceiling fan	Proximity
	Struck, hit by contact with object	*Being struck by a ceiling fan while on top bunk bed*	Proximity
		Dad lifted up out of bath into blades of fan	High intrinsic risk
Chain	Acute over - exertion	*Exercise slipped off chain and twisted foot*	Proximity
	Crushing, piercing	*Fell onto chain stradle injury with trauma to genitalia*	Proximity
	Fall	*Fall onto out streched arm tripped over a chain*	Proximity
		Playing computer slipped off chain bashed head on desk	Proximity
		Was leaning against chain and fell backwards	Proximity
Chair	Acute over - exertion	*Falling off a chair*	Proximity
		Foot caught in a recliner chair	Proximity
		Sitting on lounge chair pulled arm	Proximity
		Struck hand on chair	Proximity
		Tripped over chair while trying to catch a ball	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Chair (cont.)	Crushing, piercing	*Caught knee in reclining chair between chair and foot rest*	Proximity
		Chair flipped backwards	Proximity
		Crush injury finger chair fell on finger	Proximity
		Cut from overturned chair with sharp metal protursion	Proximity
		Fall from chair standing on chair	Proximity
		Fell backward from chair and finger crushed between chair and floor boards	Proximity
		Ssquashed fingers under a chair	Proximity
	Fall	*Climbed chair fell over railing and fell*	Proximity
		Climbed on chair standing and then fell	Proximity
		Climbing up to turn light off fell off chair	Proximity
		Fall off chair	Proximity
		Fell backward of chair	Proximity
		Fell onto chair	Proximity
		Fell over whilst running hitting face on cater wheel of chair	Proximity
		Pushed chair and fall off	Proximity
		Standing on a chair and fell off	Proximity
		Standing on chair tipped over fell	Proximity
		Tripped on chair	Proximity
	Struck, hit by contact with object	*Chair fell over hitting patient's head*	Proximity
		Fell into chair	Proximity
		Fell off chair hit on another chair	Proximity
		Hit edge of chair after a fall	Proximity
		Kicked chair	Proximity
		Knocked out tooth after falling from chair	Proximity
		Laceration to top lip climbing off dinner chair	Proximity
		Pulled chair onto self	Proximity
Change table	Acute over - exertion	*Fell off change table pulled arm when trying to catch baby*	Identified but inadequate info
	Fall	*Fall from a change table*	Identified but inadequate info
		Fall from change table	Inadequate description
		Rolled off change table	Identified but inadequate info
		Rolled off change table fell off	Maladapted/misused
		Sitting on change table, fell off	Maladapted/misused
		Standing on change table fell off	Maladapted/misused
Chemical substance	Chemical effect	*Chemical burn to face*	Identified but inadequate info
		Chemical substance in eye	Maladapted/misuse
		Ingestion of chemical substance	Maladapted/misuse

Product	Mechanism of injury	Possible scenario	PIF
Chisel gun	Crushing, piercing	*Dropped a chisel gun on foot*	Proximity
Chopping board	Burn	*Chopping board on hot stove and melted*	Proximity
	Struck, hit by contact with object	*Injury to toe after dropping chopping board on foot paracetamol 18 30 nka immunisations reported utd nil reg med nil med / surg history*	Proximity
Cigarette	Burn	*Burnt with cigarette*	High intrinsic risk
Cleaning agent	Chemical effect	*Cleaning agent sprayed in face by*	Maladapted/misuse
		Cleaning substance in eye	Maladapted/misuse
		Swallowed/ingestion cleaning agent	Maladapted/misuse
	Struck, hit by contact with object	*Sprayed cleaning agent in face*	Maladapted/misuse
Climbing apparatus	Acute over - exertion	*Fell off climbing frame*	Proximity
	Fall	*Fell while climbing in playground when got stuck and fell*	Proximity
Climbing equipment	Acute over - exertion	*Fell off ladder on climbing equipment*	Proximity
Clothes rack	Struck, hit by contact with object	*Fell onto clothes rack*	Proximity
Clothesline	Fall	*Fall off a washing line*	Identified but inadequate info
		Falling while swinging on clothes line	Proximity
Clothing	Burn	*Clothing caught fire*	Proximity
	Fall	*Slipped over on clothes*	Proximity
	Struck, hit by contact with object	*Scratched eye with t-shirt*	Proximity
Clothing hanger	Foreign body	*Foreign body plastic tip of coat hanger in ear*	Identified but inadequate info
Coffee table	Fall	*Fall from coffee table*	Proximity
		Fell off coffee table landed on left ear	Proximity
		Running around tripped and fall hitting forehead on coffee table	Proximity
		Tripped hit head on coffee table	Proximity
Coin	Crushing, piercing	*Swallowed coin*	Maladapted/misuse
	Foreign body	*Choking episode on coin*	Maladapted/misuse
		Ingested coin	Maladapted/misuse
	Suffocation	*Coin lodged in oesophagus*	Maladapted/misuse
Concrete	Burn	*N/a*	Non-manufactured
Confetti	Foreign body	*Foreign body placed Christmas decoration in ear*	Maladapted/misuse
		Swallowed foreign body plastic star	Maladapted/misuse
Container	Burn	*Burn from hot water in container*	High intrinsic risk
Cooking appliance	Burn	*Injury burn hand on hot element in kitchen*	High intrinsic risk
Cot	Acute over - exertion	*Being caught in rails of cot*	Proximity
		Fall whilst in cot	Proximity
		Foot caught down edge of mattress in cot	Proximity
	Fall	*Dropped onto metal edge of portacot while picking up*	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Cot (cont.)	Fall (cont.)	*Climbed out of cot, fell off*	Proximity
		Fall from cot	Proximity
		Fall onto cot	Proximity
	Struck, hit by contact with object	*Fall from cot onto object*	Proximity
Cotton bud	Crushing, piercing	*Bleeding ear cleaned with cotton buds*	High intrinsic risk
		Cotton bud stuck in ear	High intrinsic risk
	Foreign body	*Cotton bud in ear which broke off and has now swollen up*	High intrinsic risk
	Struck, hit by contact with object	*Stuck cotton bud into ear pulled out bleeding*	High intrinsic risk
Couch/sofa	Acute over - exertion	*Fell backwards on couch*	Proximity
	Fall	*Bouncing fell off couch*	Proximity
		Climbed couch and fell off	Proximity
		Fall from couch	Proximity
		Rolled off the couch	Proximity
Crayon	Foreign body	*Crayon in ear*	Identified but inadequate info
		Dislodge bits of crayon	Identified but inadequate info
Crib	Fall	*Tripped over crib and hit head against wall*	Proximity
Cubby house	Fall	*Fall from cubby house*	Identified but inadequate info
	Struck, hit by contact with object	*Hit head on cubby house*	Identified but inadequate info
Cup	Burn	*Burn from hot drink in cup*	High intrinsic risk
	Crushing, piercing	*Cut on coffee cup*	High intrinsic risk
		Laceration on broken coffee cup	High intrinsic risk
	Fall	*Fell onto cup*	Proximity
Cupboard	Fall	*Climbing fell from cupboard*	Proximity
		Fall from cupboard	Proximity
		Jumped from cupboard	Proximity
	Struck, hit by contact with object	*Hit against cupboard*	Proximity
		Walked into kitchen cupboard	Proximity
Curtain	Crushing, piercing	*Laceration forehead by curtain rod*	High intrinsic risk
Cutlery	Burn	*Scald*	High intrinsic risk
	Struck, hit by contact with object	*Eye injury*	High intrinsic risk
Deodorant	Chemical effect	*Sprayed deodorant in eyes*	Maladapted/misuse
	Foreign body	*Foreign body in anus inserted deodorant contacter in rectum*	Maladapted/misuse
Detergent	Chemical effect	*Poured or rubbed liquid laundry detergent into eye*	Maladapted/misuse
		Foreign body eyes washing powder into eye	Identified but inadequate info
		Got laundry powder in eye	Identified but inadequate info
		Ingested washing powder	Maladapted/misuse
Dishwasher	Burn	*Dishwasher burn*	Identified but inadequate info
	Crushing, piercing	*Cut on dishwasher*	Identified but inadequate info

Product	Mechanism of injury	Possible scenario	PIF
Dishwasher detergent	Chemical effect	*Ingestion of dishwasher tablet*	Maladapted/misuse
	Foreign body	*Rubbed detergent into eyes*	Proximity
Dog kennel	Crushing, piercing	*Climbing over dog kennell cut finger on iron*	Proximity
		Got hooked on metal roof of dog kennel	Proximity
Doll house	Fall	*Tripped over dolls cot*	Proximity
	Struck, hit by contact with object	*Fell and hit forehead on dolls house*	Proximity
Door	Fall	*N/a*	Other regulator
Dozer	Crushing, piercing	*Got caught in dozer door*	Proximity
Drain grate	Fall	*N/a*	Other regulator
Drill	Acute over - exertion	*Using a drill wrist got jarred*	High intrinsic risk
	Burn	*Touching a hot drill bit*	High intrinsic risk
	Crushing, piercing	*Thumb slipped and electric drill went through thumb*	High intrinsic risk
Drinking glass	Crushing, piercing	*Cut by glass whilst in bath*	High intrinsic risk
		Cut finger with glass	High intrinsic risk
		Fell onto broken glass	High intrinsic risk
		Stood on a piece of glass	High intrinsic risk
		Walked on glass	High intrinsic risk
	Foreign body	*Stood on piece of glass*	High intrinsic risk
	Struck, hit by contact with object	*Glass broke in sink piece flicked up into eye*	High intrinsic risk
Drum	Burn	*Using drum to burn rubbish*	High intrinsic risk
	Struck, hit by contact with object	*Laceration on drum gear that was in back of car*	Proximity
Dryer	Struck, hit by contact with object	*Ran into clothes airer*	Proximity
Ear plug	Foreign body	*Foreign body ear plug stuck in ear*	Identified but inadequate info
		Foreign body in ear swimming with ear plugs and kept pushing to keep them	Identified but inadequate info
Entertainment unit	Fall	*Tripped over entertainment unit*	Proximity
Esky	Fall	*Tripped in kitchen hit head on eski*	Proximity
Eucalyptus oil	Chemical effect	*Ingestion of eucalyptus oil*	Maladapted/misuse
Excavator	Acute over - exertion	*Lacerated hand in cane field unhooking excavator slipped cutting ring finger*	Identified but inadequate info
Exercise ball	Fall	*Fell off an exercise ball*	Proximity
Exhaust pipe	Burn	*Fell into exhasut pipe*	High intrinsic risk
		Touch exhaust pipe	High intrinsic risk
Fan	Struck, hit by contact with object	*Stuck finger in an electric fan*	Proximity
Fiberglass	Acute over - exertion	*Hit on fibreglass cast*	Proximity
Fiberglass board	Struck, hit by contact with object	*Hit on fibreglass board*	Proximity
Fire hydrant	Struck, hit by contact with object	*Running into fire hydrant*	Proximity
Fireplace	Burn	*Burnt on outside of fireplace*	High intrinsic risk

Product	Mechanism of injury	Possible scenario	PIF
Fish hook	Crushing, piercing	*Fish hook flicked under thumb nail*	High intrinsic risk
		Fish hook embedded	High intrinsic risk
		Fish hook in foot	High intrinsic risk
		Hit by fish hook	High intrinsic risk
		Jumped fence knocked fishing gaff down and landed on same piercing foot	High intrinsic risk
		Tripped over and put hook into arm	High intrinsic risk
		Trod on single barb fish hook foot	High intrinsic risk
	Foreign body	*Foreign body fish hook index finger*	High intrinsic risk
		Stood on fish hook	High intrinsic risk
		Swallowed a metal fishing sinker	High intrinsic risk
Fishing rod	Crushing, piercing	*Stabbed himself in eye with fishing rod*	Identified but inadequate info
Flying fox	Acute over - exertion	*Caught on ground when on flying fox*	Proximity
		Falling off flying fox	Proximity
	Crushing, piercing	*Finger crushed in flying fox*	Proximity
	Fall	*Contact with person and fell off*	Proximity
		Fall from flying fox	Proximity
		On flying fox at playground fell off and friend fell onto leg	Proximity
	Foreign body	*Fell off flying fox foreign body in eye*	Proximity
	Struck, hit by contact with object	*Hit foot on flying fox platform*	Proximity
		Laceration finger crushed in flying fox	Identified but inadequate info
Flying kite	Fall	*Fell over flying kite*	Proximity
Foam pit	Fall	*Sore back after jumping into foam pit*	Proximity
Fork	Crushing, piercing	*Fork utensil prong to foot*	High intrinsic risk
	Struck, hit by contact with object	*Stabbed self with a fork while trying to feed herself*	High intrinsic risk
Forklift	Crushing, piercing	*Crushed between manual fork lift and steel crate*	High intrinsic risk
		Crushed between wall and forklift	High intrinsic risk
Fort	Fall	*Fall from fort*	Proximity
		Slipped and hit on edge of fort after tripping	Proximity
Frame	Crushing, piercing	*Playing touch in the backyard slid into a steel frame*	Proximity
Freezer	Fall	*Climbed on freezer basket fell cutting outer genitalia*	Proximity
		Fell from a freezer feet hit a chair	Proximity
Fridge	Crushing, piercing	*Jammed in fridge*	Proximity
	Struck, hit by contact with object	*Bottle of wine fell off fridge and hit patient*	Proximity
Furniture	Acute over - exertion	*Contact with static object*	Proximity
	Fall	*Bumped into furniture*	Proximity
		Fell after swinging from furniture	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Gear	Acute over - exertion	*Loading gear onto bus and felt pain in back*	Proximity
Glass	Burn	*Burn from hot water in glass*	High intrinsic risk
	Crushing, piercing	*Bleeding from laceration*	Identified but inadequate info
		Broken glass in rubbish hit back of leg	Identified but inadequate info
		Cut	Identified but inadequate info
		Cut on glass while climbing tree	Identified but inadequate info
		Dropped glass on the floor	Identified but inadequate info
		Dropped photo frame picked up broken glass	Identified but inadequate info
		Fell on broken glass	Identified but inadequate info
		Hit by glass	Identified but inadequate info
		Holding onto window sill broken glass in edge of window cutting finger	Identified but inadequate info
		Injury to foot laceration	Identified but inadequate info
		Stood on glass	Identified but inadequate info
	Fall	*Falling on the grass and cut on glass*	Identified but inadequate info
		Tripped over glass	Proximity
	Foreign body	*Foreign body ingestion of small glass pieces from broken glass jar*	Identified but inadequate info
		Stood on glass	Identified but inadequate info
Glow stick	Chemical effect	*Glow stick solution in eye*	Identified but inadequate info
Glowing star	Crushing, piercing	*Playing with plastic glowing star plastic cut*	Identified but inadequate info
Glue	Burn	*Burnt on glue*	Maladapted/misused
	Chemical effect	*Ingestion of super glue*	Maladapted/misuse
		Squirting superglue into eye	Maladapted/misuse
Go cart	Struck, hit by contact with object	*Go cart ran over*	High intrinsic risk
		Go cart vs stationary truck	High intrinsic risk
Goal post	Acute over - exertion	*Fell off top of soccer goal post*	Proximity
	Fall	*Got stuck in goal netting and fell over*	Proximity
	Struck, hit by contact with object	*Collided with goalpost*	Proximity
Golf club	Struck, hit by contact with object	*Hit with golf club*	Identified but inadequate info
Grinder	Crushing, piercing	*Cut on a grinder*	High intrinsic risk
Gum	Burn	*Burn from chewing gum in a microwave*	Maladapted/misuse
Gutter	Fall	*N/a*	Other regulator
Gym equipment	Fall	*Fall from gym*	Proximity
		Fall from gym equipment	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Gym mat	Fall	*Playing on gym mats fell on outstretched hand*	Proximity
Gymnastic bar	Fall	*Fell off balancing bar gymnastics*	Proximity
Gymnastic beam	Fall	*Falling on beam at gymnastics doing handstand hit beam then floor*	Proximity
		Slipping off gym beam	Proximity
Gymnastic equipment	Struck, hit by contact with object	*Tripped over a mat and hit head against gym equipment*	Proximity
Hair dryer	Burn	*Burnt on hair dryer (on/just recently turned off)*	High intrinsic risk
Hair spray	Chemical effect	*With a hairspray bottle in hand and the smell of the hairspray on breath*	Identified but inadequate info
Hair straightener	Burn	*Burnt on hair straightener*	High intrinsic risk
		Burnt on hair straightener (on/just recently turned off)	High intrinsic risk
		Pulled hair straightener onto arm	High intrinsic risk
Hammer	Crushing, piercing	*Hammer steel bar slipped injuring hand*	High intrinsic risk
		Hit finger with hammer and block of wood	High intrinsic risk
Hammock	Fall	*Fall from hammock*	Proximity
		Fall off hammock hitting screw	Identified but inadequate info
		Fall out of hammock	Proximity
		Swinging off hammock, hammock broke, fell off	Defective
Hand tool	Crushing, piercing	*Cutting cable at work lacerated hand*	High intrinsic risk
Hand wash	Chemical effect	*Eyes with hand wash solution*	Identified but inadequate info
Headlight	Crushing, piercing	*Cut on headlight glass*	High intrinsic risk
Heater	Burn	*Burn from fireplace*	High intrinsic risk
		Burn on an oil heater	High intrinsic risk
		Burnt on heater	High intrinsic risk
		Burnt on heater crawled over to heater	High intrinsic risk
	Crushing, piercing	*Heater set on top of drawer fell and hit patient*	High intrinsic risk
Heating appliance	Burn	*Falling in a fire*	Identified but inadequate info
Heavy lift	Acute over - exertion	*Pain post carrying a heavy box*	Proximity
Helmet	Fall	*Fell during seizure landed on metal buckle of protective helmet*	Proximity
High bar	Fall	*Fell from high bar*	Proximity
High chair	Fall	*Fall from high chair*	Identified but inadequate info
		Fallen from table in tabletop highchair	Identified but inadequate info
		Fell backwards from high chair	Identified but inadequate info
		High chair stood up, no harness/strap, fell off	Maladapted/misused
	Struck, hit by contact with object	*Fell forward in high chair and bumped head on table*	Identified but inadequate info
		Fell out of high chair hitting back of head	Identified but inadequate info

Product	Mechanism of injury	Possible scenario	PIF
High jump bar	Acute over - exertion	*Ankle injured while at high jump bar landed on foot*	Proximity
Hockey	Acute over - exertion	*Fall pain playing hockey*	Proximity
Hockey puck	Acute over - exertion	*Hockey puck hit finger*	Proximity
Hockey stick	Crushing, piercing	*Crushed between hockey ball and hockey stick*	Proximity
	Struck, hit by contact with object	*Hit head by hockey stick*	Proximity
Hook	Crushing, piercing	*Metal hook stuck through finger*	High intrinsic risk
Horizontal bungee jumping	Struck, hit by contact with object	*Horizontal bungee jumping hit head on a balloon*	Proximity
Hose	Fall	*Falling/tripped over hose*	Proximity
Hot beverage	Burn	*Hot liquid burn*	High intrinsic risk
Hot coffee	Burn	*Pulled hot coffee onto face*	High intrinsic risk
Hot noodles	Burn	*Burn from hot noodles*	High intrinsic risk
		Burn with boiling water after pulling a bowl of noodles off table	High intrinsic risk
Hot oil	Burn	*Burn with hot oil*	High intrinsic risk
Hot pan	Burn	*Burn leaning on hot pot*	High intrinsic risk
		Burn on hot pan	High intrinsic risk
Hot plate	Burn	*Burn touching hot plate on stove*	High intrinsic risk
Hurdles	Acute over - exertion	*Falling over at hurdles*	Proximity
		Pain following hurdles exercise	Identified but inadequate info
	Fall	*Ankle tripped whilst hurdling*	Proximity
Ice skate	Acute over - exertion	*Fall onto outstretched hand while skating*	Proximity
		Fall whilst ice skating	Proximity
		Ice skating fall onto outstretched hand	Proximity
		Skiing arm pulled	Proximity
	Crushing, piercing	*Ice skating then fell and skate sliced fingers*	Identified but inadequate info
	Fall	*Bump by another skater, fell*	Proximity
		Fell at ice rink	Proximity
		Fell over ice skating	Proximity
		Tripped and fell while skating	Proximity
	Struck, hit by contact with object	*Hit face on ice while ice skating*	Proximity
Inflatable pool	Struck, hit by contact with object	*Allergic to plastic blow up pool*	Proximity
Iron	Burn	*Burn from iron*	High intrinsic risk
		Burn iron rail from camp fire	High intrinsic risk
		Burn pulling hot iron onto self	High intrinsic risk
		Burnt on iron (on/just recently turned off)	High intrinsic risk
Iron, jaffle	Burn	*Burnt on iron (on/just recently turned off)*	High intrinsic risk
Jaffle machine	Struck, hit by contact with object	*Reached up on a cupboard and pulled a cord and had a jaffle machine fall on head*	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Jewellery	Crushing, piercing	*Inflammation of ear post attempt at placing a stretcher ring into lobe*	Maladapted/misuse
		Piercing to under tongue	Identified but inadequate info
		Swelling tongue post piercing	Identified but inadequate info
	Foreign body	*Bead in ear*	Identified but inadequate info
		Bead up nostril	Identified but inadequate info
		Foreign body ingestion of gold ring	Maladapted/misuse
		Foreign body swallowed small plastic bead	Maladapted/misuse
		Pierced earring stuck in lobe	Identified but inadequate info
		Placed a plastic ring in throat	Identified but inadequate info
		Tongue ring stuck in tongue	Maladapted/misuse
	Struck, hit by contact with object	*Back of ear ring imbedded in ear*	Identified but inadequate info
		Injury to tooth pulled by wedding ring	Identified but inadequate info
Jolly jumper	Fall	*Baby in jolly jumper, velero gave way*	Defective
		Fall from jolly jumper	Identified but inadequate info
Jump bar	Struck, hit by contact with object	*Hit by high jump bar*	Proximity
Jumping castle	Acute over - exertion	*Fell off slide on jumping castle*	Proximity
		Someone jumped on patient in jumping castle	Proximity
	Fall	*Neck unable to move neck to fell on jumping castle*	Proximity
		Fall from jumping castle	Proximity
		Fell from jumping castle	Proximity
		Following falling on jumping castle	Proximity
	Struck, hit by contact with object	*Jumping on jumping castle fell off struck head on bike*	Proximity
Jumping pillow	Fall	*Fell off jumping pillow*	Proximity
Jungle gym	Acute over - exertion	*On jungle gym fell off slide*	Proximity
	Fall	*Fall from a jungle gym*	Proximity
	Struck, hit by contact with object	*Hit on a beam whilst playing on a jungle gym*	Proximity
Kerb	Acute over - exertion	*Tripping over kerb*	Proximity
Kettle	Burn	*Burn hot kettle*	High intrinsic risk
		Pulled kettle full off hot water to self	High intrinsic risk
Knee boarding	Fall	*Knee boarding and got dumped a few times*	Proximity
Knife	Crushing, piercing	*Cut finger*	High intrinsic risk
		Fell onto knife	High intrinsic risk
		Hit with a knife	High intrinsic risk
Knife (cont.)	Crushing, Piercing (cont.)	*Knife fell off bench and landed on foot*	High intrinsic risk
		Laceration from slicer	High intrinsic risk

Product	Mechanism of injury	Possible scenario	PIF
		Poking eyelid with knife	High intrinsic risk
Ladder	Acute over - exertion	*Pain after stepping off step ladder*	Proximity
	Fall	*Climbing into a tree using a ladder slipped and fell from ladder*	Proximity
		Fall from ladder	Proximity
		Fell off ladder	Proximity
	Struck, hit by contact with object	*Dropped ladder on toe*	Proximity
		Hit ladder while running	Proximity
Lamp shade	Struck, hit by contact with object	*Lampshade fallen hitting head*	Identified but inadequate info
Lawn mower	Crushing, piercing	*Detipped finger caught under ride on mower chain*	High intrinsic risk
		Laceration to foot using hand mower	High intrinsic risk
Ledge	Acute over - exertion	*Rolled ankle when jumped from ledge*	Proximity
		Twisting elbow going down ledge grabbed an air conditioning unit	Proximity
	Crushing, piercing	*Falling onto ledge*	Proximity
	Fall	*Fall from ledge*	Proximity
Lego	Foreign body	*Foreign body in ear lego piece*	Identified but inadequate info
		Lego piece up nostril	Identified but inadequate info
Letter opener	Crushing, piercing	*Cutting self with letter opener*	High intrinsic risk
Light bulb	Burn	*Burn after touching lightbulb*	High intrinsic risk
		Burn from a flourescent light	High intrinsic risk
		Burnt on hot lightbulb	High intrinsic risk
	Crushing, piercing	*Swallowed glass from a light bulb*	Maladapted/misuse
Lighter	Burn	*Burns from a campfire lighter fluid exploded & flame*	High intrinsic risk
		Burnt on car lighter	High intrinsic risk
		Burnt on lighter's flame	High intrinsic risk
Lollipop	Foreign body	*Ate whole lollipop including stick*	Maladapted/misuse
Machinery	Acute over - exertion	*Strained hand using machinery*	High intrinsic risk
	Crushing, piercing	*Finger caught in cement mixer*	High intrinsic risk
		Machinery fell onto foot	High intrinsic risk
		Pizza dough machine falling onto hand	High intrinsic risk
Magnet	Foreign body	*Magnets stuck in nostrils*	Identified but inadequate info
Magnetic ball	Foreign body	*Swallowed magnetic ball from game*	Maladapted/misuse
Mannequin	Struck, hit by contact with object	*Finger lacerated on steel maniquen*	Proximity
Marble	Foreign body	*Foreign body swallowed magnet size of marble*	Maladapted/misuse
		Swallowed plastic marble sized ball	Maladapted/misuse
Mat	Fall	*Fall onto outstretched hand on high jump mat*	Proximity
Mat/carpet	Fall	*Running around, tripped over mat/carpet*	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Mattress	Acute over - exertion	*Rolled off mattress on floor*	Proximity
	Fall	*Fall from mattress*	Proximity
Meat slicer	Acute over - exertion	*Replacing some meat on automatic slicer heavy metal guard fell down on top forearm*	High intrinsic risk
	Crushing, piercing	*Cut on meat slicer*	High intrinsic risk
Metal	Acute over - exertion	*Hitting metal swollen*	Proximity
	Burn	*Burn on hot metal fell on neck*	Identified but inadequate info
	Crushing, piercing	*Banged head on corner of chicken pen*	Identified but inadequate info
		Crush injury	Identified but inadequate info
		Cut with piece of sheet metal	Identified but inadequate info
		Diesel fitter hit hand on steel	Identified but inadequate info
		Fell on to piece of steel	Identified but inadequate info
		Foreign body in eye	Identified but inadequate info
		Injury laceration to leg	Identified but inadequate info
	Fall	*Fallen and hit head on metal straps*	Identified but inadequate info
		Slipped and cut leg on iron	Identified but inadequate info
		Tripped on metal	Identified but inadequate info
	Foreign body	*Foreign body steel in eye*	Identified but inadequate info
		Swallowed a metal tack	Maladapted/misuse
	Struck, hit by contact with object	*Hit on head with steel*	Identified but inadequate info
		Hit sign on footpath due to anger	Identified but inadequate info
		Pushed and fell unto a metal sheet	Proximity
		Steel dropped on patient	Identified but inadequate info
Metal - ball	Foreign body	*Swallowed a ball*	Maladapted/misuse
Metal bar	Acute over - exertion	*Playing european handball and hit hand on metal bar*	Proximity
Metal box	Struck, hit by contact with object	*Running and fell on corner of metal box*	Proximity
Metal sheet	Struck, hit by contact with object	*Metal sheet lifter fell on*	Identified but inadequate info
Microwave	Struck, hit by contact with object	*Dropped microwave rotating glass plate on toe*	Proximity
Mini bike	Struck, hit by contact with object	*Fall from battery powered bike*	Proximity
Mirror	Crushing, piercing	*Cut on sharp edge of mirror*	High intrinsic risk
		Holding a mirror and then bashed head into mirror and has cut lip	Proximity
		Taking shower shard of mirror hit head	High intrinsic risk
Mobile phone	Struck, hit by contact with object	*Hit in face with a mobile phone*	Maladapted/misuse
Money box	Crushing, piercing	*Hit in head with porcelain money box*	Maladapted/misuse

Product	Mechanism of injury	Possible scenario	PIF
Monkey bars	Acute over - exertion	*Fell from monkey bars*	Proximity
		Playing on monkey bars twisted hand	Proximity
	Fall	*Climbing bar, fell off*	Proximity
		Contact with person and fell off	Proximity
		Fell off monkey bars and hit face on some wood	Proximity
		Fell off money bars	Proximity
		Hanging upside down, fell off	Proximity
		Hit against metal bar playing on monkey bars then dropped onto feet	Proximity
		Jump off monkey bars, landed awkwardly	Proximity
		Lose grip, fell off	Proximity
		Sitting on the edge, fell	Proximity
		Swinging on bars, fell off	Proximity
	Struck, hit by contact with object	*Hit on monkey bars*	Proximity
Moth balls	Chemical effect	*Ingestion or poisioning of moth balls*	Maladapted/misuse
Motorbike	Acute over - exertion	*Motorbike fell onto patient while trying to fix it*	Proximity
Nail	Crushing, piercing	*Feeding chickens in pen tripped and stood on rusty nail*	High intrinsic risk
		Nail from nail gun penetrating hand	High intrinsic risk
		Puncture wound from nail	High intrinsic risk
		Stepped on nail protruding from deck	High intrinsic risk
		Stood on a strip of screws	High intrinsic risk
		Stood on nail	High intrinsic risk
		Stood on rusty nail	High intrinsic risk
		Tripped on plank landed on a nail	High intrinsic risk
	Foreign body	*Foreign body eat bolt*	High intrinsic risk
		Swallowed screw	Maladapted/misuse
Nail clippers	Crushing, piercing	*Cut trimming nails with clippers*	High intrinsic risk
Nail polish	Chemical effect	*Nail polish in eye*	Identified but inadequate info
		Opened nail polish jar and nail polish splashed into eye	Proximity
Needle	Crushing, piercing	*Sewing needle into elbow*	High intrinsic risk
		Sewing needle pierce through finger remains insitu	High intrinsic risk
	Foreign body	*Inhaled foreign body*	High intrinsic risk
		Sewing needle imbedded in finger/hand	High intrinsic risk
Occy strap	Struck, hit by contact with object	*Hit in eye by ocky strap trying to pull basketball hoop over wire fence with strap flicked back and hit in eye*	High intrinsic risk
		Occy strap hit in face	High intrinsic risk
Ornament	Struck, hit by contact with object	*Ceramic Christmas ornament fell on head*	Identified but inadequate info
		Closing a draw and heavy ornament hit head	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Oven	Burn	*Burn hand on hot oven*	High intrinsic risk
		Burn has had an oven tray against chest	High intrinsic risk
		Burn when opened the oven door	High intrinsic risk
		Burnt foot on oven	High intrinsic risk
		Burnt on oven door (inside/outside)	High intrinsic risk
		Burnt on oven's tray	High intrinsic risk
		Touching hot oven door	High intrinsic risk
Paint	Burn	*Paint accidently caught fire*	High intrinsic risk
	Chemical effect	*Chroming spray paint*	High intrinsic risk
Paper	Foreign body	*Foreign body in ear*	Maladapted/misuse
	Struck, hit by contact with object	*Paper plane hit eye*	Proximity
	Suffocation	*Chocked on paper*	Identified but inadequate info
Pebble	Foreign body	*Foreign body swallowed pebble*	Maladapted/misuse
		Stuck a pebble in nostril	Maladapted/misuse
		Swallowed smooth pebble	Maladapted/misuse
	Struck, hit by contact with object	*A pebble lodged in back of head*	Identified but inadequate info
Peg	Crushing, piercing	*Lac scrotum fell on tent peg*	Proximity
Pen/pencil	Crushing, piercing	*Foot cut on metal in chook pen*	High intrinsic risk
		Poked in eyelid with pen	Identified but inadequate info
	Foreign body	*Foreign body in ear pencil lead*	Identified but inadequate info
		Foreign body in stomach swallowed end of pen	Maladapted/misuse
		Foreign body nose crayon in plastic	Identified but inadequate info
		Piece of lead pencil in thigh	High intrinsic risk
	Struck, hit by contact with object	*Flicked pencil in eye*	Identified but inadequate info
		Poked in eye with a pencil	Identified but inadequate info
		Was hit with metal stunt peg	Proximity
Perfume	Chemical effect	*Sprayed self in eye with perfume*	Maladapted/misuse
Pesticide	Chemical effect	*Ate a peice of rat bait*	Maladapted/misuse
		Chroming accessed the bottle from laundry cupboard	Maladapted/misuse
		Ingestion of rat poison	Maladapted/misuse
	Crushing, piercing	*Sucking on organophosphate lid*	Maladapted/misuse
Petrol	Burn	*Added kerosene to start bbq burn*	High intrinsic risk
		Burn throwing petrol on a fire	High intrinsic risk
		Burn to face after petrol container accidently kicked onto patient	High intrinsic risk
		Facial burns from petrol and matches	Identified but inadequate info
Petrol (cont.)	Burn (cont.)	*Lit petrol (stunt)*	Maladapted/misused
		Petrol accidently caught fire	High intrinsic risk

Product	Mechanism of injury	Possible scenario	PIF
		Petrol explosion on fire	High intrinsic risk
		Petrol splash to eye trying to put petrol in car	High intrinsic risk
	Chemical effect	*Had mouthful of petrol*	High intrinsic risk
		Swallowed unleaded petrol	High intrinsic risk
Photo frame	Crushing, piercing	*Laceration on photo frame*	Identified but inadequate info
Piano	Struck, hit by contact with object	*Hit side of head on piano*	Proximity
Picket	Fall	*Playing cricket running backwards trying to catch a ball collide and fallen over a low picket fence*	Proximity
Pitch fork	Crushing, piercing	*Pitch fork through her calf gardening at the time*	High intrinsic risk
		Stabbed himself by accident with garden stake in top of foot	High intrinsic risk
	Struck, hit by contact with object	*Threw garden rake at him pierced foot*	High intrinsic risk
		Pitch fork to foot	High intrinsic risk
Plaster mold	Burn	*Making pop plaster mold, stuck in hot mold*	High intrinsic risk
Plastic	Foreign body	*Choking episode after possibly swallowing plastic sticker*	Identified but inadequate info
		Ingested small plastic white cap	Identified but inadequate info
		Swallowed plastic tag of bread	Identified but inadequate info
Plastic bag	Burn	*Burn from hot black garden plastic (hot sun)*	Proximity
Plastic bottle	Struck, hit by contact with object	*Jumped over a fence to retrieve a cricket ball another person hit him with a plastic bottle*	Proximity
Plastic doll	Foreign body	*Swallowed a little plastic doll shoe*	Maladapted/misuse
Plastic shovel	Crushing, piercing	*Cut head with plastic shovel*	Proximity
Plastic splash	Burn	*Burnt from plastic splash*	Proximity
Plastic toy	Foreign body	*In the bath on a toy plastic teacup and hurt vaginal region*	Proximity
	Struck, hit by contact with object	*Hit over head with a plastic toy*	Proximity
Plastic wrap	Foreign body	*Ingestion of with plastic from broom handle*	Maladapted/misuse
		Ingestion or poisioning of small piece of plastic lollipop wrapper	Maladapted/misuse
		Ingestion or poisioning with green plastic snorkel grip	Maladapted/misuse
Plate	Burn	*Burn on a hot dinner plate*	Proximity
	Crushing, piercing	*Cut on glass plate*	High intrinsic risk
		Foot cut on broken plate	High intrinsic risk
		Lacerated finger on broken plate	High intrinsic risk
		Lacerated head on dinner plate	High intrinsic risk
	Fall	*Ran into plate glass pool fence hit forehead*	Proximity
Platform	Fall	*Jumping from a platform in playground*	Proximity
Play dough	Foreign body	*Foreign body in ear playdough inserted*	Maladapted/misuse

Product	Mechanism of injury	Possible scenario	PIF
Playground equipment	Acute over - exertion	*Fall in sandpit*	Proximity
		Foosh from playground equipment	Proximity
		Jumped from playground equipment	Proximity
		Jumpped off jungle gym	Proximity
	Crushing, piercing	*Foot got caught in play equipment*	Proximity
		Handlebar injury to mouth	Proximity
	Fall	*Biba fall backwards from play equipment*	Proximity
		Fall in playground	Proximity
		Fall unto play equipment	Proximity
		Fell from playground equipment	Proximity
		Fell from top platform	Proximity
		Fell off a climbing wall	Proximity
		Fell off blank hit below chin on edge	Proximity
		Jumping off play equipment	Proximity
		Pushed into play equipment	Proximity
		Slipped off play eqipment	Proximity
		Tripped on play equipment	Proximity
	Struck, hit by contact with object	*Hit on bar on play equipment*	Proximity
		Injury knocked self out	Proximity
		Ran into pole of play equipment	Proximity
Playground fort	Fall	*Fell off fort*	Proximity
Playground surface	Burn	*Burnt on hot playground surface*	Proximity
Playpen	Fall	*Tripped over playpen*	Proximity
Pole	Acute over - exertion	*Jump off pole*	Proximity
	Crushing, piercing	*Cut ton steel pole*	Proximity
		Hit with metal pole	Proximity
		Jumping over wall & catching leg on jagged metal pole	Proximity
		Stabbed self with curtain pole	Proximity
	Fall	*Fall and hit on metal pole*	Proximity
		Falling around pole	Proximity
		Fell off a fireman pole	Proximity
		Missed step and smacked head into pole	Proximity
	Struck, hit by contact with object	*Fell onto a pole*	Proximity
		Has been drinking vodka had an altercation to a pole	Proximity
		Head vs post	Proximity
		Hit pole	Proximity
		Kicked pole	Proximity
Pole (cont.)	Struck, hit by contact with object (cont.)	*Playing basketball jumped up to grab metal pole which fell onto patient*	Proximity

Product	Mechanism of injury	Possible scenario	PIF
		Pushed into metal pole	Proximity
		Ran into a pole	Proximity
Polystyrene	Foreign body	*Inhaled a polysterene ball up nose*	Maladapted/misuse
Pool	Acute over - exertion	*Climbing out of pool twisted ankle*	Proximity
		Neck injury whilst playing in swimming pool	Proximity
		Pain in middle finger hit in pool	Proximity
		Swimming in pool shoulder pop out	Proximity
	Crushing, piercing	*Cut in pool*	Proximity
		Cut on concrete block	Proximity
		Cut on side of pool	Proximity
		Laceration chin on swimming pool edge	Proximity
	Fall	*Diving into pool and hit head*	Proximity
		Doing backflip off pool	Proximity
		Fell hit chin on edge of pool	Proximity
		Fell onto head over pool	Proximity
		Foot cut on tile at the swimming pool	Proximity
		Injury to teeth after slipping in pool	Proximity
		Slid backwards off diving block at pool	Proximity
		Slipped off diving board and landed on concrete	Proximity
		Slipping in pool	Proximity
		Somersault onto tiles on side of pool	Proximity
	Struck, hit by contact with object	*Back flip into pool laceration to head*	Proximity
		Dived into shallow end of swimming pool	Proximity
		Head injury fell backwards and hit head on side of pool	Proximity
		Hit head on bottom of swimming pool	Proximity
	Suffocation	*Immersion in pool*	Proximity
Pool cue	Struck, hit by contact with object	*Hit back of throat with the small end of a pool cue*	Maladapted/misuse
		Splinter from broken pool kew	Identified but inadequate info
Post	Crushing, piercing	*Cut leg on the edge of a post*	Proximity
	Fall	*Hit head on post*	Proximity
	Struck, hit by contact with object	*Hit by a winch from a school sign*	Proximity
		Punched a post	Proximity
Pot	Burn	*Burnt hand on pot*	Proximity
	Crushing, piercing	*Playing in the garden and cut arm on a terricota pot*	High intrinsic risk
		Standing on broken ceramic pot	High intrinsic risk
	Fall	*Jumping off planter box*	Proximity
Potato gun	Burn	*Burn playing with a homemade potato gun*	High intrinsic risk
Powder	Chemical effect	*Johnson baby powder in and*	Identified but

Product	Mechanism of injury	Possible scenario	PIF
		around mouth	inadequate info
Power cord	Fall	*Tripped over power cord*	Proximity
Power pack	Struck, hit by contact with object	*Hit on head by a power pack*	Proximity
Power socket	Electric, radiation effect	*Burns put remote car antenna into power socket*	High intrinsic risk
Pram/stroller	Fall	*Fall from pram not strapped in*	Maladapted/misused
		Fall onto pushchair	Identified but inadequate info
		Fell backwards from pram	Identified but inadequate info
		Fell from/out of pram/stroller	Identified but inadequate info
		Fell over pram	Identified but inadequate info
		Pram rolled, fell off	Maladapted/misused
		Pram toppled over	Identified but inadequate info
		Pushed the pram down steps /stairs was buckled	Proximity
		Standing up in pram, fell out	Maladapted/misused
		Unrestrained in stroller stood up and fell out onto pavement	Maladapted/misuse
	Struck, hit by contact with object	*Fell backwards onto floor*	Identified but inadequate info
		Fell from pram onto bitumen	Identified but inadequate info
		Knocked head on side of pram	Identified but inadequate info
		Knocked over in pram by taxi	Proximity
Quad bike	Acute over - exertion	*Came off quad bike*	Proximity
		Fall from buggy	Proximity
	Fall	*Fall from quadbike*	Proximity
	Struck, hit by contact with object	*4 wheel motorbike roll on hand*	Proximity
		Being caught in motorbike	Proximity
		Doubling on quad bike when it rolled	Proximity
		Pain foot after motorbike fell on it	Proximity
		Ran into fence quad bike	Proximity
		Riding quadbike and hit rock went over handle bars	Proximity
		Striking hand on handlebars of motorbike	Proximity
Racquet	Fall	*Tripped over racquet*	Proximity
Racquet/bat	Acute over - exertion	*Hit by pastic cricket bat*	Proximity
		Playing tennis and bent wrist	Proximity
	Crushing, piercing	*Hit by tennis racquet*	Proximity
		Hit with coconut fibre bat	Proximity
		Lac from tennis racquet	Proximity
Racquet/bat (cont.)	Fall	*Fall onto outstretched hand after tripping over cricket bat*	Proximity
		Falling with tennis racquet in hand	Proximity

Product	Mechanism of injury	Possible scenario	PIF
	Struck, hit by contact with object	*Hit by cricket bat*	Proximity
		Hit in head with cricket bat	Proximity
Radiator	Burn	*Radiator exploded*	Defective
Razor	Crushing, piercing	*Cut lip with razor*	High intrinsic risk
		Lacerated finger with razor blade	High intrinsic risk
		Pretending to shave legs scraped shin with safety razor	High intrinsic risk
		Shaved skin with razor then kicked tree	High intrinsic risk
Remote car	Crushing, piercing	*Remote car pierced hand*	High intrinsic risk
Remote control	Struck, hit by contact with object	*Struck by remote control*	Proximity
Ride	Fall	*Fall onto outstretched hand from platform of a ride*	Identified but inadequate info
Riding toy	Fall	*Flipping backwards off ride on car*	Identified but inadequate info
Rip stick	Fall	*Falling from rip stick*	Identified but inadequate info
		Fell off rip board	Identified but inadequate info
	\	*Doing a trick fell off*	Proximity
		Going down hill fell off	Proximity
		Jump off ripstick	Proximity
		Riding ripstick on road fell when hit bump in road	Proximity
Rocking horse	Fall	*Falling from rocking horse*	Proximity
Roller blade	Acute over - exertion	*Fall from rollerblades*	Proximity
	Crushing, piercing	*Laceration vagina from falling over whilst roller blading*	Proximity
	Fall	*Fall onto outstretched hand while roller blading*	Proximity
		Fell onto arm whilst rollerblading	Proximity
Roller skate	Acute over - exertion	*Fell over roller skating*	Proximity
	Fall	*Fall onto outstretched roller skating*	Proximity
		Fell off roller skates	Proximity
		Lost balance, fell off	Proximity
Rope	Acute over - exertion	*Caught foot in rope & fell*	Proximity
	Crushing, piercing	*Got thumb caught in swing rope*	Proximity
	Fall	*Fall after swinging from rope*	Proximity
		Fell while jumping over a rope	Proximity
		Head injury at water park swing on rope hit head on concrete	Proximity
		Running around quadrangle foot caught in piece of rope tripped and fell to the ground put arm out to break the fall	Proximity
		Tripped on rope	Proximity
Rope (cont.)	Struck, hit by contact with object	*Hitting on lane rope while in pool swimming*	Proximity
		Swinging on a rope & struck leg against timber saw horse	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Rose oil	Chemical effect	*Ingested rose oil*	Maladapted/misuse
Rubber	Foreign body	*Foreign body in throat swallowed rubber*	Maladapted/misuse
		Injury piece of rubber in nostril	Identified but inadequate info
		Rubber band nostril	Identified but inadequate info
	Struck, hit by contact with object	*Pain eye hit with rubber band*	Proximity
Rubbish bin	Acute over - exertion	*Fell onto metal rubbish bin*	Proximity
	Struck, hit by contact with object	*Bin fell onto patient*	Proximity
		Fall hit on corner of wheelie bin	Proximity
		Wheely bin lid hit top of head	Proximity
Ruler	Struck, hit by contact with object	*Rulers in mouth fell laceration to mouth*	Maladapted/misuse
Safety pin	Crushing, piercing	*Puncture wound from safety pin*	High intrinsic risk
	Foreign body	*Ingestion of safety pin*	Maladapted/misuse
Saucepan/pot	Burn	*Burnt on hot food/fluid from saucepan/pot*	High intrinsic risk
		Burnt on hot saucepan/pot	High intrinsic risk
Saw	Crushing, piercing	*Cut on an bench saw*	High intrinsic risk
		Laceration from a saw	High intrinsic risk
School bag	Fall	*Foosh injury arm tripped on school bag*	Proximity
Scissors	Crushing, piercing	*Cut from scissors*	High intrinsic risk
		Holding scissors when someone kicked scissors cutting leg	High intrinsic risk
		Laceration finger cutting paper	High intrinsic risk
Scooter	Acute over - exertion	*Driving a scooter on bicycle path slipped*	Identified but inadequate info
		Fall from scooter	Identified but inadequate info
		Foot hit brake injuring foot	Identified but inadequate info
		Foot twisted under scooter	Identified but inadequate info
		Handle bars of scooter knocked teeth	Identified but inadequate info
	Crushing, piercing	*Caught toe between back wheel and brake on scooter*	Identified but inadequate info
		Getting caught in scooter	Identified but inadequate info
		Ran onto brick wall whilst riding a scooter	Identified but inadequate info
		Slipped off scooter	Identified but inadequate info
	Fall	*Being doubled on scooter patient fell off*	Identified but inadequate info
		Collision fell off	Proximity
		Doing a trick fell off	Proximity
Scooter (cont.)	Fall (cont.)	*Fall from scooter*	Inadequate description
		Fall from scooter, hit handlebars	Inadequate description

Product	Mechanism of injury	Possible scenario	PIF
		Fell off power wing scooter	Identified but inadequate info
		Jumping scooter over ramp fell off	Identified but inadequate info
		Lost balance, fell off	Proximity
		Riding a scooter fell slipped	Identified but inadequate info
		Tooth was knocked out on the scooter	Identified but inadequate info
	Struck, hit by contact with object	*Collided with a scooter*	Identified but inadequate info
		Fell off scooter hit object	Identified but inadequate info
		Hit by scooter	Identified but inadequate info
		On scooter and got hit by a car	Proximity
Screwdriver	Crushing, piercing	*Screwdriver thrown and hit eye*	High intrinsic risk
Seat	Fall	*Fell off a seat*	Proximity
Seatbelt	Struck, hit by contact with object	*Bruising to chest from seatbelt involved in rta car vs power pole*	Proximity
Seesaw	Crushing, piercing	*Cut on seesaw*	Proximity
	Struck, hit by contact with object	*Hit head on seesaw*	Proximity
		Seesaw tipped over hitting back of head	Proximity
Shaving cream	Chemical effect	*Shaving cream into eye*	Identified but inadequate info
Shoe	Acute over - exertion	*Rolled ankle when walking in high heel shoes*	Proximity
		Twisted knee on spiked shoes	Proximity
	Fall	*Tripped and fell over shoe*	Proximity
	Struck, hit by contact with object	*Hit by shoe*	Proximity
		Kicked on heel of shoe and has lifted the nail	Proximity
		Shoe hit vagina as slid down the slippery slide	Proximity
		Shoe horn fell on foot	Proximity
		Tripping over a shoe	Proximity
Shoelace	Acute over - exertion	*Tripped on shoelace*	Proximity
	Fall	*Tripped over shoelace*	Proximity
Shopping trolley	Fall	*Climbed up shopping trolley toppled over & fell*	Proximity
		Fall from shopping trolley	Inadequate description
		Leaned over the edge of shopping trolley, tipped, fell off	Inadequate description
		Standing on trolley fell off	Maladapted/misused
		Tripped over shopping trolley	Proximity
		Two kids on trolley, toppled over, fell out trolley	Maladapted/misused
Shovel	Crushing, piercing	*Stood on shovel*	High intrinsic risk
	Struck, hit by contact with object	*Laceration above eye after falling onto a shovel*	High intrinsic risk
Silica gel	Chemical effect	*Ingestion of silica gel*	Maladapted/misuse

Product	Mechanism of injury	Possible scenario	PIF
Skateboard	Acute over – exertion	*Fell off skateboard*	Identified but inadequate info
		Rolled ankle while skateboarding	Identified but inadequate info
	Crushing, piercing	*Crush injury by skateboard*	Identified but inadequate info
		Fall while skateboarding	Identified but inadequate info
	Fall	*Collision fell off*	Proximity
		Doing a trick fell off	Proximity
		Fall backwards skateboarding	Identified but inadequate info
		Fall from skateboard	Inadequate description
		Fall from skateboard, hit handlebars	Inadequate description
		Fall onto outstretched hand while skateboarding	Identified but inadequate info
		Lost balance, fell off	Proximity
		Riding skateboard of a jump	Identified but inadequate info
		Skateboarding, skateboard came out from under patient	Identified but inadequate info
	Struck, hit by contact with object	*Eversion injury skateboarding*	Identified but inadequate info
		Falling off skateboard and rolling on ankle	Identified but inadequate info
		Fell off skateboarding and put out hand to stop fall bent fingers	Identified but inadequate info
		Finger caught under skateboard	Identified but inadequate info
		Playing on a skateboard hit by a bike	Proximity
		Skateboarding skated off steps	Identified but inadequate info
		Slipping off skateboard	Identified but inadequate info
Ski	Fall	*Fall from ski*	Inadequate description
Skipping rope	Fall	*Head injury tripped whilst skipping*	Proximity
		Tripped over skipping rope	Proximity
Slasher	Struck, hit by contact with object	*Hit by rock thrown up by slasher*	Proximity
Sleeper	Struck, hit by contact with object	*Dropped heavy sleeper on foot*	Proximity
Sleeping bag	Fall	*Slipped and bashed chin on zip of sleeping bag*	Proximity
Slide	Acute over - exertion	*Fall down slide*	Proximity
		Fall from slippery slide	Proximity
		Fell off wet slippery dip	Proximity
		Jumped off slide	Proximity
		Jumping on slide twisted foot	Proximity
Slide (cont.)	Crushing, piercing	*Fall on slippery slide*	Proximity
	Fall	*Climbing, fell off*	Proximity
		Fall from slippery slide	Proximity

Product	Mechanism of injury	Possible scenario	PIF
		Fall on slide	Proximity
		Fell off slide	Proximity
		Pushed, fell off	Proximity
	Struck, hit by contact with object	*Going down a slippery dip other kids came down & landed on patient*	Proximity
		Lacerated chin fell from slide	Proximity
		Slide on parents lap leg became caught up under	Proximity
Sling shot	Struck, hit by contact with object	*Hit in eye by small rock shot from sling shot*	High intrinsic risk
		Shot by sling shot fired ballbearing shooter	High intrinsic risk
Slow cooker	Burn	*Burn to hand after touching slow cooker*	High intrinsic risk
Smoke alarm	Struck, hit by contact with object	*Head injury being held in mums arms while the smoke alarm was going off mum tried to stop it and the casing and battery fell onto baby's head*	Proximity
Snow board	Fall	*Fell off while snowboarding*	Proximity
Soap dispenser	Struck, hit by contact with object	*Finger caught in soap machine*	Proximity
Soap holder	Crushing, piercing	*Cut on ceramic soap holder*	Proximity
		Struck a broken ceramic soap dish	Proximity
	Struck, hit by contact with object	*Hit on the soap holder*	Proximity
Soldering iron	Burn	*Stood on a soldering iron burn*	High intrinsic risk
Spa	Struck, hit by contact with object	*Hit head on spa and smashed vent*	Proximity
		Slipped fell when getting out of spa	Proximity
Sparkler	Burn	*Burn hand from a sparkler*	High intrinsic risk
		Burnt on sparkler	High intrinsic risk
Spatula	Struck, hit by contact with object	*Hit with a spatula*	Proximity
Splinter	Crushing, piercing	*Foreign body in eye threw some wood*	Identified but inadequate info
		Jumping into river and got splinter in foot	Identified but inadequate info
		Splinter in foot riding motorbike went through shoe	Identified but inadequate info
		Stood on piece of wood pierced through	Identified but inadequate info
	Foreign body	*Choking episode*	Identified but inadequate info
		Foreign body in side hair line friend swing stick hiting on fence & a piece of stick broke off & ricochet hitting head	Identified but inadequate info
		Foreign body in eye	Identified but inadequate info
		Splinter on toe	Identified but inadequate info
		Stick in ear	Identified but inadequate info
Splinter (cont.)	Struck, hit by contact with object	*Pulling bark off tree something in eye*	Identified but inadequate info
		Ran into tree foreign body in eye	Identified but inadequate info

Product	Mechanism of injury	Possible scenario	PIF
		Some went into the eye	Proximity
		Splinter from wooden floor	Identified but inadequate info
Spoon	Foreign body	*Foreign body swallowed end of spoon*	Identified but inadequate info
Staple	Foreign body	*Industrial staple through ring finger*	Identified but inadequate info
		Mouth full of open staples	Identified but inadequate info
Star picket	Acute over - exertion	*Fall onto elbow after running into star picket*	Proximity
Steam mop	Burn	*Steam burnt form steam mop*	Inadequate description
Sterilizer	Burn	*Burnt from steam/hot water from sterilizer*	High intrinsic risk
Stool	Acute over - exertion	*Foot barstool landed on foot*	Proximity
	Fall	*Fall from stool'*	Proximity
		Fallen off a stool landing onto a bike	Proximity
		Hit back of stool	Proximity
	Struck, hit by contact with object	*Fell from stool hitting corner of stool*	Proximity
		Hit on stool	Proximity
		Running into stool	Proximity
Stove	Burn	*BBQ pushed button had gas explotion burns*	High intrinsic risk
		Burn to both hands from stove top	High intrinsic risk
		Burn to hand after touching pot bellied stove	High intrinsic risk
		Burnt on stove's flame/stove's hot plate	High intrinsic risk
		Child being placed on hot plate accidently	Maladapted/misused
		Climbed up on the stove and stood on hot plate	High intrinsic risk
		Smoke / fumes inhalation, bottles on stove and water boiled dry filling house with smoke	High intrinsic risk
		Touching hot stove burnt	High intrinsic risk
		Tripped over and touched stove	Proximity
Stud	Foreign body	*Swallowing press stud*	Identified but inadequate info
	Struck, hit by contact with object	*Tackle playing rugby struck stud*	Proximity
Surfboard	Fall	*Falling off a surfboard*	Proximity
	Struck, hit by contact with object	*Came off board*	Proximity
		Hit by surfboard	Proximity
Swimming cap	Suffocation	*Had swimming cap over face*	Maladapted/misuse
Swing	Acute over - exertion	*Fall from swinging on a beam*	Proximity
		Fall off swing	Proximity
		Jumping off swing	Proximity
		Was swinging on swings hurt arm	Proximity
Swing (cont.)	Crushing, piercing	*Crush injury to forfinger caught finger in swing*	Proximity
	Fall	*Climbing swing hurt arm*	Proximity

Product	Mechanism of injury	Possible scenario	PIF
		Fall off swing	Proximity
		Fell backwards off swing	Proximity
		Jumped backwards off swing	Maladapted/misused
		Jumped off swing	Proximity
		Pushed off swing	Proximity
		Swing and rope broke fell	Defective
	Struck, hit by contact with object	*Knocked over by swing*	Proximity
		Ran in front of swing pushed to the ground	Proximity
Swing chair	Fall	*Sitting in swing chair fell out*	Identified but inadequate info
Syringe	Crushing, piercing	*Stabbed in back with used syringe*	High intrinsic risk
Table	Acute over - exertion	*Hit hand on desk*	Proximity
		Table dropped on hand	Proximity
	Crushing, piercing	*Coffee table fell onto patient*	Proximity
		Laceration from a table	Proximity
		Leant on a glass table and went through it	Proximity
		Standing on coffee table and tipped over	Proximity
		Tripped over and hit on table	Proximity
	Fall	*Fall from table*	Proximity
		Fall from table hit head on door knob	Proximity
		Fall from top of dressing table	Proximity
		Fall injury head vs table	Proximity
		Fall into edge of table	Proximity
		Fell from coffee table	Proximity
		Fell off computer table	Proximity
		Fell off kitchen table	Proximity
		Fell off pool table	Proximity
		Jumped off table	Proximity
		Running along table fell and hit head on edge of table	Proximity
		Tripping over and hit on table	Proximity
	Struck, hit by contact with object	*Fell onto table*	Proximity
		Hit on table	Proximity
		Running into table	Proximity
		Tripped fell forward against table	Proximity
Table, massage	Fall	*Fall from massage table*	Proximity
Table, pool	Fall	*Climbing and fell off*	Proximity
Tackle bag	Acute over - exertion	*Bending finger back when tackling tackle bag*	Proximity
		Pain in neck during rugby practice tackling bags	Proximity

Product	Mechanism of injury	Possible scenario	PIF
	Fall	*Fell over tackle bag playing rugby*	Proximity
Telescope	Struck, hit by contact with object	*Hit on telescope*	Proximity
Television	Crushing, piercing	*TV fell onto patient pinned under tv*	High intrinsic risk
	Fall	*Playing near television and fell and hit forehead on corner of TV unit*	Proximity
	Struck, hit by contact with object	*Hit on TV*	Proximity
		Pulled TV off shelve	High intrinsic risk
		TV fell on head	High intrinsic risk
Tennis net	Fall	*Fell while trying to jump over tennis net*	Proximity
		Tripped over net	Proximity
Thermometer	Struck, hit by contact with object	*Poked thermometer into ear*	Maladapted/misuse
Tin	Crushing, piercing	*Dropped can of soft drink on toe*	High intrinsic risk
		Hit by tin lid	Proximity
		Jumped off, fallen onto edge of tin	High intrinsic risk
		Laceration on tin lid	High intrinsic risk
		Running and step on a piece of broken off corrugrated tin	High intrinsic risk
Tissue	Foreign body	*Tissue stuck up nostril*	Identified but inadequate info
Toaster	Burn	*Burn from sandwich toaster*	High intrinsic risk
Tootbrush	Struck, hit by contact with object	*Fell on toothbrush scraped roof of mouth*	Proximity
Tooth pick	Crushing, piercing	*Toothpick embedded*	Proximity
Torch	Struck, hit by contact with object	*Hit by torch*	Maladapted/misuse
Toy	Fall	*Tripped over toy*	Proximity
Toy - hammer	Struck, hit by contact with object	*Struck with timber toy hammer*	Proximity
Toy - hulk	Foreign body	*Hulk toy up nostril*	Identified but inadequate info
Toy - unspecified	Acute over - exertion	*Kicked toy*	Proximity
		Pain arm threw toy with some force	Proximity
	Crushing, piercing	*Collided with someone holding a hard plastic toy*	Proximity
		Prying toy apart with teeth slipped caught lip between parts	Proximity
	Fall	*Fall against toy*	Proximity
		Fall off toy	Proximity
		Fell from steps onto toy	Proximity
		Tripped over toy	Proximity
	Foreign body	*Foreign body in ear*	Identified but inadequate info
		Foreign body in nostril	Proximity
		Swallowed plastic toy	Maladapted/misuse
Toy – unspecified (cont.)	Struck, hit by contact with object	*Hit by someone with toy*	Proximity
		Hit head on steel toy	Proximity

Product	Mechanism of injury	Possible scenario	PIF
Toy - wooden	Struck, hit by contact with object	*Tripping and falling onto wooden toy*	Proximity
Toy aeroplane	Crushing, piercing	*Stood on toy*	Proximity
	Struck, hit by contact with object	*Injury eye poked in eye by toy*	Proximity
Toy bicycle	Struck, hit by contact with object	*Impact with toy bike*	Proximity
Toy box	Struck, hit by contact with object	*Hit against a toy box*	Proximity
Toy brick	Fall	*Fall from box*	Proximity
Toy car	Fall	*Fell off bed hit head on toy car*	Proximity
		Fell off toy car	Proximity
	Struck, hit by contact with object	*Fell off plastic car and bumped head on floor*	Proximity
		Struck by fast moving remote control car	Proximity
Toy fence	Foreign body	*Part of a toy fence embeded in foot stood on it*	Proximity
Toy garage	Fall	*Tripped and fell and hit lip on toy garage*	Proximity
Toy gun	Foreign body	*Fired cap gun point blank at eye*	Proximity
	Struck, hit by contact with object	*Hit with a toy gun*	Proximity
Toy motor bike	Struck, hit by contact with object	*Puncture wound from toy motor bike handle*	High intrinsic risk
Toy nail	Foreign body	*Foreign body swallowed toy nail*	Maladapted/misuse
Toy shovel	Struck, hit by contact with object	*Hit by plastic shovel*	Proximity
Toy sword	Struck, hit by contact with object	*Hit by toy sword*	Proximity
Toy tiger	Foreign body	*Swallowed a toy tiger*	Proximity
Toy train	Struck, hit by contact with object	*Toy train hit on forehead*	Proximity
Toy truck	Fall	*Fall onto tonka truck while running*	Proximity
	Struck, hit by contact with object	*Hit on forehead with large toy truck*	Proximity
Trampoline	Acute over - exertion	*Fall off trampoline*	Identified but inadequate info
		Fall off trampoline, caught body part on spring	Identified but inadequate info
		Fall off trampoline, hit concrete floor	Identified but inadequate info
		Fall on trampoline	Proximity
		Finger caught in trampoline	Proximity
		Flipping on trampoline, neck injury	Proximity
		Hit on trampoline while jumping on trampoline	Identified but inadequate info
		Hit on trampoline's spring	Identified but inadequate info
		Jumping on trampoline, body part injured	Identified but inadequate info
		Jumping on trampoline, crushed by other player	Identified but inadequate info
Trampoline (cont.)	Acute over – exertion (cont.)	*Knee injury on trampoline*	Identified but inadequate info
		Landed awkwardly while jumping on trampoline	Identified but inadequate info

Product	Mechanism of injury	Possible scenario	PIF
		Landed awkwardly while jumping on trampoline, neck injury	Proximity
		Pulled arm while jumping on trampoline	Proximity
		Rolled ankle while jumping on trampoline	Identified but inadequate info
	Crushing, piercing	*Entrapment on trampoline's spring*	Identified but inadequate info
		Jumped off trampoline and landed on a plastic toy	Proximity
		Bit tongue jumping on a trampoline	Proximity
	Fall	*Bounced off to ground*	Proximity
		Doin a trick, fell off	Proximity
		Doing a flip, landed on head, neck flexed	Proximity
		Fall on trampoline	Identified but inadequate info
		Fall onto head on trampoline	Proximity
		Fall whilst on trampoline	Identified but inadequate info
		Falling awkwardly on trampoline	Proximity
		Fell backwards from trampolie	Identified but inadequate info
		Fell off trampoline	Identified but inadequate info
			Proximity
		Fell off trampoline, hit object nearby	Identified but inadequate info
		Fell onto trampoline's spring	Identified but inadequate info
		Fell through broken net	Defective
		Fell through opening in the net	Inadequate description
		Fell through springs	Inadequate description
		Fell through trampoline's spring	Identified but inadequate info
		Fell through unzipped net	Maladapted/misused
		Flipped off trampoline	Proximity
		Jumped from trampoline to verandah	Proximity
		Jumped off trampoline	Proximity
		Jumped off trampoline, fell on ground	Proximity
		Jumping on trampoline, another jumped on trampoline, fell off	Proximity
		Jumping on trampoline, fell on arm	Identified but inadequate info
		Jumping on trampoline, fell straddled on edge	Proximity
		Jumping on trampoline, pushed on netting, zip gave way	Identified but inadequate info
Trampoline (cont.)	Fall (cont.)	*Multiple jumper*	Maladapted/misused
		Playing on trampoline, pushed by dog off trampoline	Proximity
		Playing on trampoline, safety net unzipped, fell off	Maladapted/misuse

Product	Mechanism of injury	Possible scenario	PIF
		Rolled ankle while on trampoline, fell	Identified but inadequate info
		Trampoline tipped, fell off	Defective
	Foreign body	*Jumping on trampoline, something went in ear*	Proximity
		Jumping on trampoline, something went in eye	Proximity
	Struck, hit by contact with object	*Collided with another person on trampoline*	Proximity
		Entrapped in trampoline's spring	Identified but inadequate info
		Fell onto trampoline's bar	Identified but inadequate info
		Fell onto trampoline's frame	Identified but inadequate info
		Flip onto trampoline bar	Identified but inadequate info
		Getting off trampoline, twisted ankle	Proximity
		Hit body part while jumping on trampoline	Identified but inadequate info
		Hit by metal pole while jumping on trampoline	Identified but inadequate info
		Hit on trampoline	Identified but inadequate info
		Holding trampoline up, jumped on it, struck by trampoline's bar	Proximity
		Jumped on by another person while on trampoline	Proximity
		Jumping on trampoline, hit nearby object	Proximity
		Kicked metal bar of trampoline	Identified but inadequate info
		Leg of trampoline fell on	Proximity
		Struck by falling trampoline that was standing on its side	Proximity
Treadmill	Burn	*Fallen off treadmill burns*	Proximity
		Touched under treadmill	High intrinsic risk
		Tripped over, caught hand under treadmill	High intrinsic risk
	Crushing, piercing	*Touched treadmill whilst going laceration*	Proximity
	Fall	*Fall from treadmill hitting back of head stiff neck*	Proximity
		Was on the treadmill when shot off the back of it landed on slate floor and hand was still attached to treadmill	Proximity
	Struck, hit by contact with object	*Friction burn caught in treadmill*	Proximity
Tricycle	Fall	*Fell backwards off trike*	Proximity
		Fell off tricycle	Proximity
		Foot went under tricycle	Proximity
		Knocked out front teeth feel against tricycle	Proximity
		Went down ramp with push along toy bike fell off bike	Proximity
Tricycle (cont.)	Struck, hit by contact with object	*Laceration hit a pole after riding small bike*	Proximity
Trolley	Acute over - exertion	*Foosh from moving trolley*	Identified but inadequate info

Product	Mechanism of injury	Possible scenario	PIF
....	Fall	*Fall from shopping trolley*	Proximity
		Fall from shopping trolley standing up in seat landed on side head no loss of consciousness eyes rolled back quiet vomit with ambulance intermittent episodes aloc	Proximity
		Trolley was pulled over while patient still strapped into seat	Proximity
	Struck, hit by contact with object	*Hit by shopping trolley*	Proximity
		Hit on a shopping trolley	Proximity
		Tripping hit shopping trolley	Proximity
Tweezers	Crushing, piercing	*Stuck metal tweezers in eye*	Identified but inadequate info
Umbrella	Struck, hit by contact with object	*Poked in eye by an umbrella*	Proximity
Unspecified	Fall	*Bent thumb back at footy*	Proximity
Vacuum cleaner	Fall	*Climbed onto vacuum and fell onto head*	Proximity
		Tripped on vacuum cord	Proximity
Vaporiser/humidifier	Burn	*Put hand on vaporiser/humidifier*	High intrinsic risk
		Steam burnt form vaporiser/humidifier	High intrinsic risk
Video game	Fall	*Tripped over video game*	Proximity
Wabble board	Acute over - exertion	*Bounced off wabble board*	Proximity
Wading pool	Burn	*Burnt on hot water in wading pool*	High intrinsic risk
Wake board	Acute over - exertion	*Wake boarding struck underwater*	Proximity
	Struck, hit by contact with object	*Hit on wake board*	Proximity
Water board	Fall	*Fall over water board*	Proximity
Water cooler	Struck, hit by contact with object	*Playing footy was pushed and landed on water machine*	Proximity
		Water cooler fell onto patient	Identified but inadequate info
Water gun	Struck, hit by contact with object	*Hit by water gun*	Identified but inadequate info
Water ski	Acute over - exertion	*Water sking pulled shoulder*	Identified but inadequate info
	Fall	*Laceration whilst water skiing*	Proximity
		Water skiing fell off	Proximity
	Struck, hit by contact with object	*Waterskiing hit on head with surf ski*	Proximity
Water tank	Acute over - exertion	*Ran into water tank*	Proximity
	Fall	*Falling off water tank*	Proximity
		Jumped off rain water tank	Proximity
	Struck, hit by contact with object	*Tripped over hit fish tank*	Proximity
Waterslide	Crushing, piercing	*Caught finger while going down water slide*	Proximity
	Fall	*Slid on water park surface*	Identified but inadequate info
Waterslide (cont.)	Fall (cont.)	*Falling off water tank*	Proximity
		Jumped off rain water tank	Proximity

Product	Mechanism of injury	Possible scenario	PIF
	Struck, hit by contact with object	*Climbed backwards up waterslide slid hit slide*	Proximity
		Hit on water slide	Proximity
Weight lifting	Acute over - exertion	*Dropped weight onto foot*	Identified but inadequate info
	Crushing, piercing	*Laceration, dropped weight onto foot*	Identified but inadequate info
		Dropped weight onto finger	Identified but inadequate info
	Struck, hit by contact with object	*Playing under weight bar, weight fell on patient*	Proximity
		Weight lifting bar fell onto patient	Proximity
Welding equipment	Electric, radiation effect	*Piece of metal in eye while welding*	High intrinsic risk
Wheel	Burn	*Contact burn with disc brake in car's wheel*	Proximity
Wheelbarrow	Crushing, piercing	*Wheelbarrow fell and trapped finger crush*	Proximity
	Fall	*Tripping over wheelbarrow and hit head on trolley*	Proximity
Wheelchair	Fall	*Wheelchair rolled down a slope and fell backwards off embankment*	Identified but inadequate info
Whistle	Crushing, piercing	*Injury to hard palate of mouth with whistle blower*	High intrinsic risk
Wire	Crushing, piercing	*Cut on wire*	Identified but inadequate info
		Stepped on wire laceration	Proximity
Wooden drumstick	Crushing, piercing	*Poked a wooden drumstick in mouth*	Proximity
Wrist buddy	Acute over - exertion	*Had wrist buddy on and pulled away and pulled wrist*	Proximity
Yoyo	Struck, hit by contact with object	*Foreign body in ear was playing with yoyo when dropped and broke and ball bearing bounced into ear*	Defective
Zipper	Foreign body	*Ingestion of metal zipper handle*	Maladapted/misuse